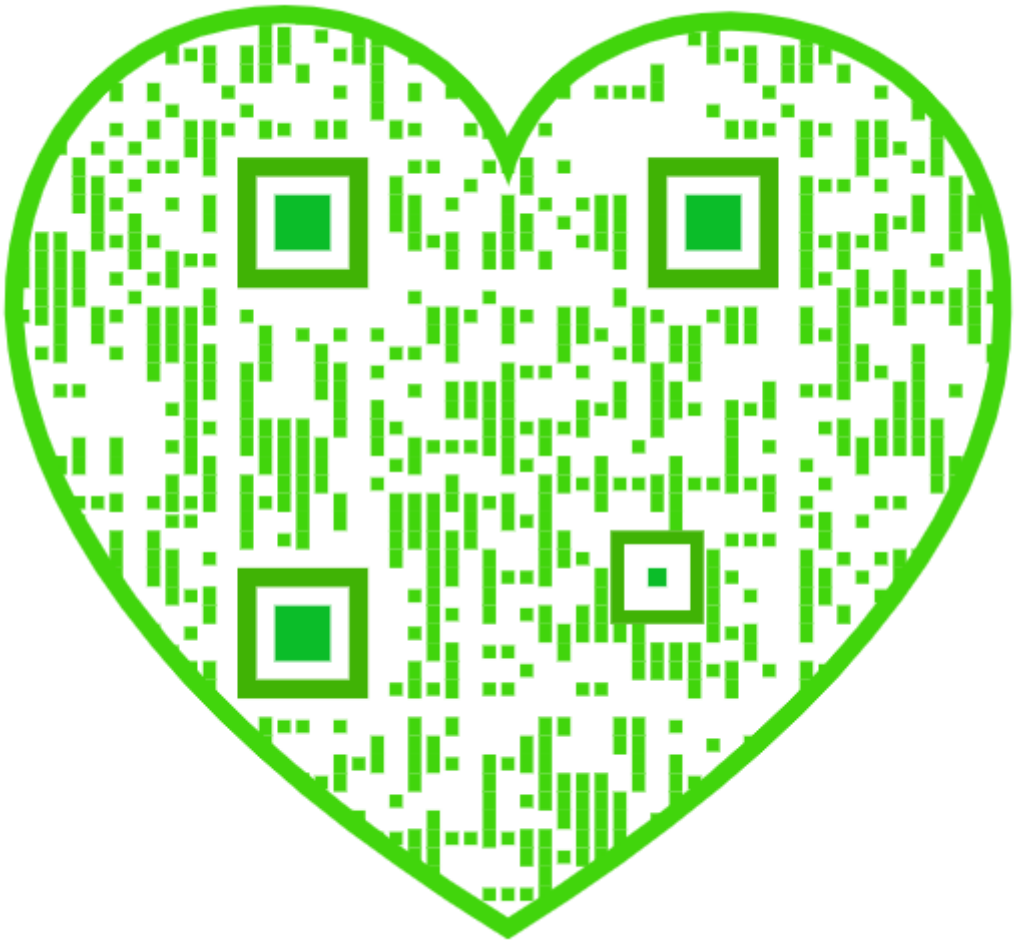
8b
TT
199.4
P6
1899



Lawrence Library

PEPPERELL.

695-3

No. [redacted]

No book shall be kept from the Library more than two weeks at one time under penalty of one cent per day for each day of detention; a book may be renewed once, but not more than once.

All books shall be returned to the Library on or before the 21st day of February, annually, under penalty of 25 cents for each book not returned.

Borrowers may take two books at the same time, provided no more than one of them shall be a work of Fiction.

Special attention is called to the following Law of our Commonwealth:

"Whoever wilfully and maliciously writes upon, injures, defaces, tears or destroys any book, plate picture, engraving or statue belonging to any Law, Town, City or Public Library, shall be punished by a fine not less than five dollars, nor more than one thousand dollars for each offence."

HINTS

AND

PRACTICAL INFORMATION

FOR

CABINET-MAKERS, UPHOLSTERERS, AND FURNITURE MEN GENERALLY.

TOGETHER WITH

A DESCRIPTION OF ALL KINDS OF FINISHING. WITH FULL DIRECTIONS THEREFOR—VARNISHES—POLISHES—STAINS FOR WOOD—DYES FOR WOOD—GILDING AND SILVERING—RECEIPTS FOR THE FACTORY—LACQUERS, METALS, MARBLES, ETC.—PICTURES, ENGRAVINGS, ETC.—MISCELLANEOUS.

NEW YORK:
THE INDUSTRIAL PUBLICATION COMPANY
1899.

THE GETTY CENTER
LIBRARY

PREFACE.

WHILE a large amount of the matter contained in this work has been published before in some shape or other, it was found in many instances incorrect, and therefore unreliable; this was in a great measure owing to the carelessness and want of knowledge on the part of the compilers, for there can be no doubt that the original recipes, methods, etc., were in the main correct; but in the frequent reproductions, errors, omissions, and interpolations occurred. It has been the aim of the publishers of the present work to make all necessary corrections, and to render the work as reliable as may be; and to this end neither expense nor pains have been spared, and much new matter that has not been generally known before has been added to that which has been public property for a long time. That the work will be found a valuable aid to the operative cabinet-maker, furniture man, and to wood-workers generally, there is not the least doubt, and its price has been kept down to such a point as will not be beyond the means of the average workingman.

New York, 1884.

TABLE OF CONTENTS.

DESCRIPTION OF CABINET-MAKING, Designing, Framing, Veneering, Inlaying, Carving, Reeding, Mouldings, Figures, Composition Ornaments, - 20

FILLING.—Fillers for Walnut, for Light Woods, for Cherry, for Oak, for Rosewood, Sizing, - - - - - - - - - - - - - - - - - - 25

APPLICATION OF VARNISHES.—Brushes for Varnishing, Varnish Pan, - 29

RUBBING, - 30

FLOWING AND POLISHING.—Flowing, Varnish, Polishing, - - - - - 31

VARIETIES OF FINISH.—Dead Finish, Varnish Finish, Wax Finish, Imitation Wax Finish, Ebony Finish, French Polishing, The Ingredients, French Polish, Improved Polish, Water-proof Polish, Prepared Spirits, Polish for Turner's Work, - - - - - - - - - - - - - - - - - - 38

STAINING.—Black Stain, Brown Stain, Walnut Stain, Oak Stain, Rosewood Stain, Cherry Stain, Red Stain, Mahogany Stain, Surface Stains, Crimson Stain, Purple Stain, Blue Stain, Green Stain, Yellow Stain, To Brighten Stains, - 43

DYEING WOOD.—Black Dye, Blue Dye, Yellow Dye, Green Dye, Red Dye, Purple Dye, Liquid for Brightening and Setting Colors, Orange Dye, Silver Gray Dye, Gray Dye, - - - - - - - - - - - - - - - 47

GILDING, SILVERING AND BRONZING.—Gilding, The Requisites, Sizes, Oil-Size, Parchment-Size, Gold-Size, To Prevent Gold Adhering, Oil-Gilding, Burnish-Gilding, Preparing the Wood-work, Polishing, Applying the Size, Laying the Gold, Burnishing, Matting or Dead-Gold, Finishing, Shell-Gold, Silver-Size, Composition for Frames, Ornaments, To Manipulate Gold Leaf, Bronzing, - - - - - - - - - - - - - - - - 55

GRAINING AND COLOR WORK.—Graining, The Process, Graining-Grounds, Light Wainscot Oak, Darker Wainscot Oak, Dark Oak, Very Dark Oak, Mahogany, Rosewood, Bird's Eye Maple, Graining-Grounds, Mixing Colors, Cream Color, Pearl Grey, Fawn, Buff, Straw, Drab, Purple, Violet, French Grey, Silver, Dark Chestnut, Salmon, Peach Blossom, Lead, Dark Lead, Chocolate, Light Yellow, Stone, Olive Green, Grass Green, Carnation, Imitation of Gold, Colors for Outlines of Ornaments, Tones, Tints, Shades, Tempera, Distemper, Color Harmony in Grained Work, Chinese White, Mixing White Lead, Varnish Green, - - - - - - - - - 69

VARNISHES.

GUMS AND THEIR QUALITIES.—Amber, Anime, Copal, Oil Varnishes, Spirit Varnishes, Lac, Sandarac, Mastic, Damar, Resin, - - - - - - 71

THE SOLVENTS.—Linseed-Oil, Oil of Turpentine, Alcohol, Naphtha, - - 72

PREPARATION OF OIL VARNISHES.—Copal Varnish, Artists' Virgin Copal, Cabinet Varnish, Best Body Copal, Carriage Varnish, Wainscot Varnish, Pale Amber Varnish, - - - - - - - - - - - - - - 82

PREPARATION OF SPIRIT AND TURPENTINE VARNISHES.—Best White Hard Spirit Varnish, White Hard Varnish, White Spirit Varnish, Brown Hard Spirit Varnish, Hard-wood Lacquer, French Polish, Bleached Shellac, Lacquer for Brass, Colored Lacquers, Mastic Varnish, Turpentine Varnish, Crystal Varnish, Paper Varnish, Water Varnish, Sealing-Wax Varnish, Black Varnish, Varnish for Iron, Varnish for Cane and Basket Work, 96

POLISH REVIVERS, ETC.

POLISH REVIVERS.—French Polish Revivers, Furniture Reviver, Furniture Cream, Furniture Paste, Several Receipts for Furniture Cream, White Furniture Cream, - - - - - - - - - - - - - - - 98

GLUE.

GLUE.—To Prepare Glue, Mixing Glue, Glue Pot, To Prevent Glue Cracking, Strong Glue to Resist Moisture, Portable Glue, - - - - - - 101

MISCELLANEOUS RECEIPTS.

TO RAISE OLD VENEERS.—To Take Out Bruises in Furniture, To Make Paste for Laying Cloth or Leather, Cements for Stopping Flaws in Wood, Mahogany; Colored Cement, Cement for Turners, Tracing Paper, Mounted Tracings, Cracks in Drawing Boards, To Temper Tools, Hardening Tools, To Cut Steel Scrapers, To Remedy Splits in Circular Saws, Brazing Band-Saws, Saw Sharpening, Oiling Tools, To Mark Tools, Varnish for Tools, Boiler Incrustation, Non-Conducting Coverings for Steam Pipes, To Harden Wood Pulleys, To Prevent Belts Slipping, Rasps, Soft Files, Amalgam Varnish, Painting and Preserving Ironwork, Preparing Soft Solder, To Clean Silver Filigree, Bronzing on Metal, Polishing Metals, Imitation Marble, To Polish Marble, To Clean Marble, To Remove Stains from Marble, To Clean Pictures, Cleaning Varnished Pictures, Cleaning Engravings, To Smooth a Damaged Picture, Embossed Gilding for Illuminating, Gold for Illuminating, To Stain Horn in Imitation of Tortoise Shell, To Stain Ivory or Bone Red, Black, Green, Blue, Yellow, To Soften Ivory, To Bleach Ivory, Artificial Ivory, Cement for Joining Leather, Cement for Leather and Wood, Cement for China, Cement for Glass, Cement for Aquariums, To Restore the Elasticity of Caned Chair Bottoms, Moths in Carpets, To Destroy Moths in Carpets, To Clean Carpets, To Make Parchment Transparent, Tinting on Parchment, India Ink Running, Erasing India Ink, To Make Carbon Paper, Removing Oil Stains from Tiles, To Polish Floors, Black Wax, Green Wax, To Polish Tortoise Shell or Horn, To Clean Looking-Glasses, To Remove Ink Stains, To Remove Stains from Wood, To Clean Velvet, To Remove Paint or Stain from Wood, To Remove Varnish from Wood, Tests for Gilding, Anti-Attrition, To Remove Grease from Cloth, Putty, How to Boil Linseed-Oil, Mordants for Staining Wood, Picture Frames, Varnish for Tools, Painting on Zinc, Violin Varnish, Staining Beech, Staining Mahogany, Bronzing Inlaid Work, Black Stain, Brown Stain, Red Stain, Walnut Stain, - - - - - - - - 128

PRACTICAL INFORMATION

FOR CABINET-MAKERS, UPHOLSTERERS AND FURNITURE MEN.

———:o:———

CONSTRUCTIVE CABINET-MAKING.

HE general term cabinet-making is the art of making all such parts of the furniture of a dwelling-house as are made of wood, together with the art of chair-making, etc., and in order to arrive at any degree of perfection, the knowledge of designing, carving, modelling, etc., is requisite.

It has also been supposed that a knowledge of geometry, and particularly of that portion of it which treats of the description of curved lines, is of great use to the cabinet-maker; but, with the exception of a knowledge of perspective, and of a few simple methods of drawing common curves, geometry may be dispensed with, though it would be better to possess it.

The best advice we can give the cabinet-maker, in acquiring a graceful, easy, and free method of drawing, is, to draw as much from nature, or from good casts, as possible. It is not of material consequence whether vegetable or animal forms be drawn, but a mixture of both is desirable, as they have very distinct characters, which will be easily traced in attempting to delineate them.

General Remarks on Designs for Cabinet Work.—In design, the central or principal part of the object requires most notice. The other parts should be so far subordinate

to it as not to distract the attention from the centre; and yet they should be so united in harmony with it as to be obviously essential to complete the design.

The connection between the principal and the inferior portions of the designs should be preserved by the continuance of some of the leading lines of the principal part to the inferior ones; and, whether these lines be straight or curved, they should never be so far interrupted by ornament as to render it doubtful whether or not they are continued; and, as the idea of firmness or stability is a necessary accompaniment of good taste in the design of furniture, the leading lines of the principal part of the design should descend in such a manner to the base as to give an idea of firmness, as far as the nature of the thing requires it.

Proportion, as it depends on the relative *magnitude of parts*, is, sometimes, wholly left to the good taste of the designer; and, when cases occur where it is within his power, one part in a design must form the principal object, and ought not to have a rival in magnitude; also, when the piece of furniture is seen in its best position, this principal part should be as near the centre of the whole as possible.

The principal part of a design should be sufficiently prominent for the eye to pass from it to the whole, or the reverse, without perceiving the change of magnitude to be abrupt; and the same remark applies to the relation of the subordinate parts of the design to the principal one.

If this attention be given to the proportion of the parts so that the eye may pass from the consideration of one to another, and not feel the change abrupt, the design will be pleasing.

If too small a proportion be assigned to the principal part, the design will be flat and unmeaning. If the proportion be too large, the whole will be absorbed in the part, as a modern mansion is not unfrequently all portico. A due proportion of the principal part to the whole gives boldness and propriety.

Richness is produced by introducing as much ornament as the object will bear, without destroying the relation between the plain and ornamental parts; a design, overcharged with ornament, becomes frittered, and wants both variety and repose.

The opposite quality to richness is meagreness, or a deficiency of ornament; and want of attention to its proportions. Between the extremes of overcharging and meagreness an immense variety of degrees of combination of ornamented with plain surfaces may be selected.

When the ornament consists of moulded work only, the piece of furniture is termed plain; but in rich furniture the combined effect of moulded and carved work is necessary. In either species, the proportions of the ornamental and plain parts to each other should be regulated by like principles as the magnitude of the parts.

Colored Woods, Metals, Etc.—Sometimes richness of effect is no further attempted than is obtained by the natural beauty of the wood which is employed; and when this natural beauty is considerable, this simple kind of furniture is most highly valued.

But wood, so fine in color and figure, as alone to give richness of effect to furniture, is very rare, and still more frequently defective; hence, the more usual mode of combining different colored woods, or of metals and shells with woods, require some degree of attention. The prevailing combinations are formed by colored bands, lines, and ornaments of wood, or by lines, beads, or ornaments of brass; the brass being in many instances cut into beautiful forms and further embellished by engraved lines on its surface.

The circumstances to be attended to in forming these combinations are harmony of color, due proportion of the colored parts to one another, and relief by contrast.

Much depends on the color of the principal mass of the piece of work, which we call the predominating color. If this color be rich, very little variety of other colors should be added. On the contrary, if the predominating color be light and delicate, it will bear to be enlivened and supported by contrast with fine lines or borders of an opposing color: taking care that the mass of opposing colors be so small as not to produce opposition instead of contrast; for contrast skilfully managed, gives force and lustre to the ground, while opposition destroys even its natural beauty.

Framing.—Framing, in cabinet-making, requires the same

precautions as in joinery, when it is required to form large surfaces, for, owing to shrinkage, and warping of wood, large even surfaces can be formed only by means of panelling.

The width of the style of a frame should be one-sixth of the whole width of a compartment of the frame; the tenons should be one-fourth of the thickness of the framing, and the width of a tenon not more than five times its thickness.

But, where surfaces of considerable width are to be formed without an appearance of framing, whether those surfaces are to be veneered or not, we should avoid framing them with other pieces where the grain of the wood is in the contrary direction, for the difference of the shrinkage of the two ways of the wood is so considerable, that it can scarcely be expected to stand without either warping or splitting when confined. Where warping is to be prevented, we strongly recommend that holes should be bored through, and strong iron wires inserted, at short distances apart, across the piece. These would act as clamps in preventing warping, and, at the same time, would not be affected by the shrinkage in width.

Angles are formed in various ways, depending chiefly on the object of the work. External angles of mouldings are either simply mitred or rebated, or both rebated and mitred together. Internal angles are generally grooved together, with the outer edges mitred. Where the front edge only is to be mitred, a dovetail groove is made, and rather narrower at the back than at the front, so that the tongue tightens as it is driven in.

When a strong firm connection is wanted, and the wood is to be joined end to end, dovetailing is to be preferred. When the dovetails are not to appear, they may be formed by the method called lap-dovetailing; and, when the dovetails are cut through, it becomes the kind used to join the angle between the front and end of a drawer. When a joint is to appear as if it were mitred, the method of dovetailing employed is called mitre-dovetailing. The apparent edges are in this case always mitred to a depth of about an eighth of an inch. There is also the method of joining by keys; the parts being neatly mitred, then saw-kerfs are to be made for

the slips of wood called keys, which are to be inserted with glue when the joint is put together.

Drawers are mostly dovetailed together, but variously made in other respects. Well-seasoned wood should always be used, as otherwise the drawers are liable to break at the joints; the tenons should always be in the direction of the grain of the wood. In mortising, care must be taken that the mortise and tenon are neatly fitted, neither too loose or too tight, and the parts well glued when put together.

Veneering, Banding, etc.—Veneering is the method of covering an inferior wood with a surface of a very superior kind, so that the parts of the article of furniture thus manufactured which meet the eye appear to the same advantage as if the whole work were of the best description. If this be well performed, it is very durable, looks well to the last, and is attainable at an expense considerably less than a similar article would cost if manufactured of the same wood throughout, but of an inferior quality.

The principal requisite to ensure success in veneering, is to select well-seasoned wood for the ground, and to use the best and strongest glue.

Veneers are worked either by a veneering hammer or by cauls. In veneering by the hammer, the ground should be warmed by the fire, and the outside of the veneer wetted with warm water or thin glue, with a sponge, and the side to be laid covered with a coat of thin glue and warmed at the fire; the veneer should be quickly laid on the ground and worked with the hammer, backwards and forwards, till neither air or glue will come out. Veneering with the hammer is preferable when the veneers are straight and even, but as that is seldom the case, work is generally done with a caul.

A caul is made of solid wood, shaped to the surface to be veneered; it should be well heated, then oiled and greased; it is screwed down upon the veneer, and the heat and pressure sends out the glue, causing the veneer to bed close to the ground. The veneers should be of an even thickness when worked by a caul, otherwise the glue will collect, and the work is liable to blister; it should not dry too quickly.

To Raise Old Veneers.—In repairing old cabinets, and other furniture, workmen are sometimes at a loss to know how to get rid of those blisters which appear on the surface, in consequence of the glue under the veneer failing or causing the veneer to separate from the ground in patches; and these blisters are frequently so situated, that, without separating the whole veneer from the ground, it is impossible to introduce any glue between them to relay it; the great difficulty in this case is to separate the veneer from the ground without injuring it, as it adheres in many places too fast to separate without breaking it. We will here, therefore, show how this operation may be performed without difficulty, and the veneer preserved perfectly whole and uninjured, ready for relaying as a new piece. First wash the surface with boiling water, and with a coarse cloth remove dirt or grease; then place it before the fire, or heat it with a caul; oil its surface with common linseed oil, place it again to the fire, and the heat will make the oil penetrate quite through the veneer and soften the glue underneath; then whilst hot raise the edge gently with a chisel, and it will separate completely from the ground; be careful not to use too great force, or you will spoil your work; again, if it should get cold during the operation, apply more oil, and heat it again; repeat this process till you have entirely separated the veneer, then wash off the old glue, and proceed to lay it again as a new veneer.

Banding is a term applied to a narrow strip of veneer used as a border, or part of a border, either to a large veneer or to solid wood; in the latter case, a rebate is sunk for the banding. Banding is of three kinds: it is called straight-banding when the wood is cut lengthwise of the grain; cross-banding when the wood is cut across the grain; and feather-banding when cut at an angle between the two.

Between the banding and the central part, one or more lines are generally inserted, and sometimes a narrower band.

The joints of banding should be as well matched as possible, both in respect to color and grain; and, excepting the mitre-joints, it is an advantage to make the joints at the veins of the wood.

Inlaying, etc., etc.—Inlaying is an expensive method of ornamenting furniture with fancy woods, metals, shells, etc., and if not well executed is unsightly and liable to frequent breakage. It is of great antiquity, and was brought to great perfection about the 16th century; it was revived about the end of the 17th century in France, but met with little encouragement, though practiced by some eminent artists—amongst the most famous for the excellence and extent of his works was one Boalle, or Buhl, from whence we take the name of Buhl-work. It has been much in use in England, France and America during the last twenty years, to form ornamental borders, chess tables, etc.

In this art the part for the ornament and that for the ground are glued together, and the design being drawn upon one, both are at once cut through by a very fine species of bow-saw. Thus, there are four parts obtained, which, being put together in two, the one is the ornament designed in its proper ground; and the remainder of the ground, combined with the remainder of the ornament, gives another pattern called the reverse.

The plates of brass or other metal should be of the usual thickness of a veneer, or as thin as can be conveniently worked, and made rough on both sides with a coarse file, or toothing plane. The veneers of wood or other matter to be combined with them, should also be toothed; and, both the plates and veneers being warmed, first pass a coat of glue over one of the metal plates and cover it with a thin sheet of paper, then coat the paper with glue, and cover it with the veneer. Place them between two smooth and even boards, and let them be kept together either by a screw-press or by hand-screws, and remain till dry; they will then be found to adhere together with sufficient firmness for cutting to the pattern.

The pattern should be drawn on the veneer, or if, from the color, it should not be sufficiently distinct, a piece of paper may be pasted on the veneer, and after it is dry the design may be drawn upon it. The lines of the pattern should be cut with a bow-saw having a very thin and narrow blade; such a saw may be made of part of a watch-spring, and the bow or the stretcher of the saw is required to be at such a distance from the blade as will admit the latter to turn

and follow the lines of the pattern in any direction. The frame of the saw should be as light as possible. Where the pattern does not in any place approach the edge, a small hole must be made for inserting the saw; and it is usual to saw upwards, that mode of sawing rendering it more easy to follow the lines correctly. When the whole of the pattern is cut out, the veneer or shell may be separated from the metal by exposing them to steam, or to warm water.

The next object is to join the parts so as to produce two complete ornaments; the one composed of veneer inlaid with metal, the other of metal inlaid with veneer. For this purpose, on a plain surface, place a piece of paper of sufficient size, and the veneer upon it, then with strong glue insert the metal part in the veneer, and rub it well down with the veneering-hammer and glue; next cover the whole with another piece of paper, and place it between two plain boards, which had been previously well warmed and rubbed with tallow, and screw or press them together. If this be properly done, the work will separate from the boards when dry; and, the paper being removed, it may be laid in its place as a veneer; but a caul is usually employed in preference to the hammer. The reverse pattern, it is obvious, should be prepared for laying in the same manner.

The process is the same whether metal and wood or metal and tortoiseshell, or two woods of different colors be used.

Inlaying with Shaded Wood.—Having shown the methods of cutting out and veneering, we need now only show the method used to produce that shady brown edge, on works inlaid with white holly, and which, when well executed, has a very pleasing and ornamental effect; the method is as follows:—

Into a shallow iron or tin pot, put a sufficient quantity of fine dry sand, to be level with the top edge of it; place it on the fire till it is quite hot, then having your veneer cut out to the required pattern, dip the edges into the hot sand, and let them remain till the heat has made them quite brown; but be careful not to burn them: it is best to bring them to a proper color by repeatedly renewing the operation, than all at once, as you then do not injure the texture of the wood, and by immersing more or less of the edge

you produce a shaded appearance to your satisfaction. I would here recommend the workman, previous to beginning the operation, to have his pattern before him shaded with umber, or any brown color, in those parts that the wood is to be stained, as he then will be enabled, as he proceeds, to copy the various shades of the pattern, for the wood when once shaded cannot be altered; and as much of the beauty of this work depends on a proper judgment in placing your shadows, it is best always to have a guide to go by, that we may produce the best possible effect. Sometimes it is requisite to give a shadow in the centre, and not on the edge of your wood, and as this cannot be done by dipping it in the sand, you must do it by taking up a little of the hot sand and sprinkling it or heaping it up on those parts required to be darkened, letting it remain a short time, then shaking it off, and, if necessary, apply more where the color is not deep enough.

To Imitate Inlaying of Silver Strings, etc.—This process is sometimes employed in the stocks, etc., of pistols, and if well executed has a very good effect; carefully draw your pattern upon the work, and then engrave, or cut away the different lines with sharp gouges, chisels, etc., so as to appear clean and even, taking care to cut them deep enough, and rather under, like a dovetail, to secure the composition afterwards to be put in the channels. The composition to resemble silver may be made as follows: take any quantity of the purest and best grain tin, melt it in a ladle or other convenient receptacle, add to it, while in fusion, the purest quicksilver, stirring it to make it incorporate; when you have added enough, it will remain in a stiff paste; if too soft, add more tin, and if not sufficiently fluid add quicksilver; grind this composition on a marble slab, or in a mortar, with a little size, and fill up the cuttings or grooves in your work, as you would with a piece of putty; let it remain some hours to dry, when you may polish it off with the palm of your hand, and it will appear as if your work was inlaid with silver. Instead of tin you may make a paste of silver leaf and quicksilver, and proceed as above directed; you may also, for the sake of variety in your work, rub in wax of different colors, and having levelled the surface and cleaned off your

work, hold it at a moderate distance from the fire, which will give your strings a good gloss.

Carving, Reeding, etc.—In carving, the quality of the wood is of the utmost importance. It should be free from cracks, knots, etc., and as even in its texture as possible, and, above all, well seasoned.

The first thing to be done is to draw your pattern on the wood in its proper proportions; this is called boasting, and in it consists the chief art of carving, as he who is the best skilled in drawing, has the best idea of the quantity of projection that should be given to the respective parts, to accord with the given design. After making out the sketch, the carver has to shape the outline with saws or gouges, and then make out the prominences of each part when necessary or proper, by gluing on pieces of wood for that purpose. The roughly-formed pieces are fixed for carving, and, in some cases, this is done by gluing them to a board, with paper inserted between, to enable the carver to take the carving off with more ease when it is finished. When the work is properly fixed, the carver proceeds to place his gouges; and, by a judicious choice of such kinds only as will suit the turn of the parts in boasting, endeavors not to have more than he can use without confusion.

The principal lines of the whole are then formed, so as to be a sufficient guide to finishing, when it is completed with gouges and cutting tools of various kinds.

The union of carved and turned work has almost always a beautiful effect; but, in producing richness with the smallest degree of labor, the combination may be carried to a great extent.

Reeding is a kind of ornament much in use in all parts of turned work. It is far better than fluting or cabling, for it has a bolder effect in small work than in fluting. When reeding is introduced on flat surfaces, there should always be an odd number, as 3, 5, 7, etc., the centre one being a trifle bolder in table legs, bed pillars, etc.

Moulding Ornaments, Figures, etc., in Imitation of Carving.—To avoid the expense of carving in wood, several attempts have been made to cast figures and ornaments to

resemble wood. The most approved process we here present our readers. It was invented by M. Lenormand, and rewarded at the Exposition of French Products, in 1823.

Make a very clear glue with two parts of Flanders glue, and one part of isinglass, by dissolving the two kinds separately in a large quantity of water, and mix them together after they have been strained through a piece of fine linen, to separate the filth and heterogeneous parts which could not be dissolved. The quantity of water cannot be fixed, because all kinds of glue are not homogeneous, so that some require more and some less; but the proper degree of liquidity may be known by suffering the mixed glue to become perfectly cold; it must then barely form a jelly. If it happens that it is still liquid when cold, a little of the water must be evaporated by exposing the vessel in which it is contained to heat. On the other hand, if it has too much consistence, a little warm water must be added. The glue, thus prepared, is to be heated till you can scarcely endure your finger in it; by this operation a little water is evaporated, and the glue acquires more consistence. Then take raspings of wood or sawdust, sifted through a fine hair-sieve, and with the glue form it into a paste, which must be put into plaster or sulphur moulds, after they have been well rubbed over with linseed or nut-oil, in the same manner as when plaster is to be moulded. Care must be taken to press the parts into the mould with the hand, in order that the whole may acquire the perfect form; then cover it with an oiled board, place over it a weight, and suffer it in that manner to dry. The drying may be hastened a little, and rendered more complete, by a stove. When the casting is dry remove the rough parts, and if any irregularities remain behind they must be smoothed, and then the ornament may be affixed with glue to the article for which it is intended.

It may be varnished or polished in the usual manner. This operation is exceedingly easy; nothing is necessary but moulds, and, with a little art, the ornament may be infinitely varied.

The species of ornament called *Composition Ornament* is used where the mass is not great, and the surface can be covered with gilding or paint, and is not exposed to wear. Sunk roses, and

other ornaments, which are protected by projections or mouldings, may be done in this manner, and it may be successfully applied to all objects beyond the reach of accident.

The composition is made as follows:—Mix 14 pounds of glue, 7 pounds of rosin, ½ pound of pitch, 2½ pints of linseed oil, and 5 pints of water (more or less, according to the quantity required). Boil the whole together, well stirring till dissolved; adding as much whiting as will render it of a hard consistency; then press it into your mould, which has been previously oiled with sweet oil.

No more should be mixed than can be used before it becomes sensibly hard, as it will require steaming before it can be again used.

Composition ornaments should be well glued on, and, in some cases, they will require to be further secured by needle-points or brads.

Composition ornaments are chiefly used for picture and glass frames; we have also seen them employed for ornaments on the top of oak book-cases, and, when grained by a good painter, they answer as well as when carved in wood.

FINISHING.

Wood Finishing is the process of applying to the surface after it has been prepared, by filling and smoothing, or otherwise, a thin coating of varnish or other substance, to render it durable, enhance its beauty or change its appearance. There are numerous methods of finishing, and a variety of materials are used; the varieties of varnish being the principal. The distinctive qualities of these varieties are treated under their proper headings.

In their natural state all woods are more or less porous, consisting of bundles of hard fibres, with interstices filled with a softer substance. These constitute the grain, and as the hard or soft parts predominate the wood is said to be hard, fine, or close-grained, or soft and open-grained. To fill these softer parts, or pores, and give to the whole an even, uniform surface, hard, and capable of a brilliant polish, is the object of the finishers' art. This hard, firm sur-

face was formerly gained by the successive application of several coats of varnish, at least three preliminary coats being required to fill the pores; the inequalities were then reduced by fine sand or glass-paper, and several additional coats laid on, the last, after becoming thoroughly hard, being polished if desired. In this operation, however, a great quantity of varnish is absorbed by the open pores of the wood, and it is consequently so expensive that it is now seldom used. Recourse is therefore had to various plans to render the wood non-absorbent before applying varnishes, and certain compounds called fillers are largely used for this purpose.

Richness of effect may be gained in decorative woodwork by using woods of different tone, such as amaranth and amboya, or inlaying and veneering. The Hungarian ash and French walnut afford excellent veneers, especially the burls or gnarls. A few useful notes on the subject are given by a recent American authority. In varnishing, the varnishes used can be toned down to match the wood, or be made to darken it, by the addition of coloring matters. The patented preparations, known as "wood fillers," are prepared in different colors for the purpose of preparing the surface of wood previous to the varnishing. They fill up the pores of the wood, rendering the surface hard and smooth. For polishing mahogany, walnut, etc., the following is recommended: Dissolve beeswax by heat in spirits of turpentine until the mixture becomes viscid; then apply, by a clean cloth, and rub thoroughly with a flannel or cloth. A common mode of polishing mahogany is by rubbing it first with linseed oil, and then by a cloth dipped in very fine brickdust; a good gloss may also be produced by rubbing with linseed oil, and then holding trimmings or shavings of the same material against the work in the lathe. Glass-paper, followed by rubbing, also gives a good lustre.

Logwood, lime, brown soft-soap, dyed oil, sulphate of iron, nitrate of silver exposed to the sun's rays, carbonate of soda, bichromate and permanganate of potash, and other alkaline preparations, are used for darkening the wood; the last three are specially recommended. The solution is applied by dissolving one ounce of the alkali in two gills of boiling water, diluted to the required tone.

The surface is saturated with a sponge or flannel, and immediately dried with soft rags. The carbonate is used for dark woods. Oil tinged with rose madder may be applied to hard woods like birch, and a red oil is prepared from soaked alkanet root in linseed-oil. The grain of yellow pine can be brought out by two or three coats of japan, much diluted with turpentine, and afterwards oiled and rubbed. To give mahogany the appearance of age, lime water used before oiling is a good plan. In staining wood, the best and most transparent effect is obtained by repeated light coats of the same. For oak stain a strong solution of oxalic acid is employed; for mahogany, dilute nitrous acid. A primary coat or a coat of wood-fillers is advantageous. For mahogany stains, the following are given: 2 oz. of dragon's blood dissolved in one quart of rectified spirits of wine, well shaken, or raw sienna in beer, with burnt sienna to give the required tone; for darker stains, boil half a pound of madder and 2 oz. of logwood chips in one gallon of water, and brush the decoction while hot over the wood; when dry, paint with a solution of 2 oz. of potash in one quart of water. A solution of permanganate of potash forms a rapid and excellent brown stain.

The Processes.— Finishing, although comprehending many minute sub-divisions, may be divided into four principal processes, *i. e.*, "Filling," "Varnishing," "Rubbing," and "Flowing," "Polishing," etc. Each of them are treated at length in their proper order, and for full information regarding the successive operations, the learner must refer to these heads; here we shall give a general view of the entire operation without details. The process described is for fine work. First make the article to be finished quite clean and free from dust; then apply the proper filler with a brush; rub it well into the grain with excelsior or tow, rubbing across the grain when practicable, then clean all the surplus filler from the surface with rags; after filling, allow the article to stand for several hours, during which time the filler should become quite hard and dry. Before proceeding to apply the varnish, if necessary, make the surface of the filler quite smooth with sand-paper; then apply

a coat of varnish, allowing it to get quite hard; after the last coat of varnish, with fine sand-paper, sand-paper the surface sufficiently to make it entirely smooth and remove any lumps or irregularities. The number of coats required depends greatly upon the quality of filler used, regarding which some remarks will be found under the head of FILLERS. It is said that with some fillers one coat of varnish is sufficient, but this can scarcely be the case with fine work, as it is not possible for one coat of varnish to give sufficient body to rub a four, or possibly three coats are more desirable. When the last coat of varnish has been applied, the article is ready for "rubbing" with pumice stone, moistened with linseed oil and applied with a bit of hair-cloth or coarse rag. This is for the purpose of making the varnish perfectly smooth and preparing it for the polishing. After rubbing, if a dead finish is desired, the work is complete, but the body of the work is generally cleaned up with a little oil well rubbed in, which gives it a lustre, afterward rubbed with a cloth dampened with alcohol, which removes the surplus oil from the surface. The veneered panels are either "flowed" or "polished," which processes are described under these heads.

FILLING.

Fillers.—These compounds play a very important part in the art of finishing, not only in the great economy of material and time required, but in producing a handsomer and more durable finish than possible, except at great cost, without them. Oil is sometimes used as a filler, but its use is not recommended; applied directly to the wood its effect is to swell the fibres, or "raise the grain," which remains in that condition until the oil becomes entirely dry, or disappears. During all this time the fibres are gradually shrinking, and consequently moving or checking the varnish. The qualities essential to a good filler are: that it shall readily enter the porous portion of the wood, and shall very soon harden and render the wood impervious to the varnish, which should lie smoothly upon the surface, giving brilliancy and effect to the natural beauty of the wood; that it shall not raise the grain of the wood; that it

shall not change the color of the wood. These conditions are satisfactorily filled by very few of the home-made fillers ordinarily used in shops, and while we give a number of receipts, our readers are advised that they will obtain better satisfaction, at less cost, by purchasing some of the patent fillers now coming into general use, of which we can recommend the very excellent fillers of the Bridgeport Wood Finishing Co., New York, and J. W. Kenna & Co., Chicago. In these fillers very little oil is used and a large amount of dryers, so that the wood becomes perfectly dry and hard in a few hours, preventing any swelling or shrinking of the fibres of the wood after the varnish is applied. The following fillers should be allowed to dry until quite hard. About eight hours are usually sufficient.

Walnut Filler.—For Medium and Cheap Work.—10 lbs. bolted English whiting, 3 lbs. dry burnt umber, 4 lbs. Vandyke brown, 3 lbs. calcined plaster, ½ lb. Venetian red, 1 gal. boiled linseed oil, ½ gal. spirits turpentine, 1 quart black japan. Mix well and apply with brush: rub well with excelsior or tow, clean off with rags. For Imitation Wax-Finish.—5 lbs. bolted whiting, 1 lb. calcined plaster, 6 ounces calcined magnesia, 1 ounce dry burnt umber, 1 ounce French yellow, 1 quart raw linseed oil, 1 quart benzine spirits, ½ pint very thin white shellac. Mix well and apply with a brush. Rub well in and clean off with rags. Before using the above filling give the work one coat of white shellac. When dry, sand-paper down and apply the filler. For First-Class Work.—3 lbs. burnt umber ground in oil, 1 lb. burnt sienna ground in oil, 1 quart spirits turpentine, 1 pint brown japan. Mix well and apply with a brush; sand-paper well; clean off with tow and rags. This gives a beautiful chocolate color to the wood.

Filler for Light Woods.—5 lbs. bolted English whiting, 3 lbs. calcined plaster, ½ gallon raw linseed oil, 1 quart spirits turpentine, 1 quart brown Japan, and sufficient French yellow to tinge the white. Mix well and apply with a brush, rub in with excelsior or tow, and clean off with rags. *Another.*—10 lbs. bolted English whiting, 5 lbs. calcined plaster, 1 lb. corn starch, 3 ounces calcined

magnesia, 1 gallon raw linseed oil, ½ gallon spirits turpentine, 1 quart brown japan, 2 ounces French yellow. Mix well and apply with brush, rub in with excelsior or tow, and clean off with rags.

Filler for Cherry.—5 lbs. bolted English whiting, 2 lbs. calcined plaster, 1½ ounces dry burnt sienna, 1 ounce Venetian red, 1 quart boiled linseed oil, 1 pint spirits turpentine, 1 pint brown japan. Mix well, rub in with excelsior or tow, and clean off with rags.

Filler for Oak.—5 lbs. bolted English whiting, 2 lbs. calcined plaster, 1 ounce dry burnt sienna, ½ ounce dry French yellow, 1 quart raw linseed oil, 1 pint benzine spirits, ½ pint white shellac. Mix well, apply with brush, rub in with excelsior or tow, and clean off with rags.

Filler for Rosewood.—6 lbs. bolted English whiting, 2 lbs. calcined plaster, 1 lb. rose pink, 2 ounces Venetian red, ½ lb. Vandyke brown, ½ lb. brandon red, 1 gallon boiled linseed oil, ½ gallon spirits turpentine, 1 quart black japan. Mix well, apply with brush, rub in with excelsior or tow, and clean off with rags.

Sizing.—Size of different kinds is sometimes applied to the surface of wood to prevent absorption of the varnish. The kind of material used for the size is not important, the object being only to prevent absorption by a very thin coat of some substance not soluble in the varnish. For dark-colored woods, thin size, made by reducing ordinary glue with water, is generally used; but for lighter-colored surfaces, a white size is used, which is prepared by boiling white kid or other leather, or parchment cuttings, in water for a few hours, or until it forms a thin jelly-like substance, which is reduced with water to a thin consistency, and used in a tepid state. Sometimes solutions of isinglass or tragacanth are employed in like manner.

Unlike the best fillers, sizes of any kind do not improve the finish, and are sometimes a positive detriment to it. They are used solely as an economy to reduce the quantity of the varnish needed, and their use is not recommended for the best work.

APPLICATION OF VARNISHES.

Preliminary to applying the varnish the pores of the wood should be filled, according to instructions given in the preceding receipts. Sufficient time should be allowed for the filler to become perfectly hard, and if any lumps or inequalities remain, the surface should be made perfectly smooth by the use of glass paper. All dust, specks, etc., should be carefully removed by the brush made for that purpose, and the work is then ready for the varnish.

Varnishes of all kinds should be uniformly applied, in very thin coats, sparingly upon the edges and angles, where the varnish is liable to accumulate. In first placing the brush on the surface, it should be applied, not close to the edge, which would be liable to give too thick a coat at that part, but at a little distance from the edge, and the strokes of the brush should be directed towards the ends alternately, with steady rapid strokes, and only very moderate pressure. If the surface is small, the whole may be passed over in one operation, and then the brush may be returned to the edge at which work was begun, and it may be passed over the surface a second or a third time, to distribute the varnish uniformly, and work out the air bubbles. Sometimes, in small surfaces, the second series of strokes is made at right angles to the first, in order to distribute the varnish more equally, and the third is laid on in the same direction as the first; but unless this is done expeditiously and equally, it leaves cross-lines, which injure the appearance of the work.

Large surfaces are more difficult, as the varnish thickens too rapidly to allow of the entire surface being covered at one operation. They must therefore either be worked gradually from the one edge to the other, as in laying a tint of water-color, or the varnish must be applied upon separate portions successively; but it is rather difficult to join the portions without leaving irregular marks. It may, however, be successfully accomplished by thinning off the edge with light strokes of the brush made in the same direction as those on the finished portion; but some care is required to avoid disturbing the former coat while it is still soft and easily acted upon by the fresh varnish. In the same manner, in laying on a second or

any subsequent coat of varnish, care must be taken not to continue the application of the brush sufficiently long to disturb the previous coat, which is speedily softened by the fresh varnish; and if the application of the brush were continued too long, the preceding coat would be disturbed, giving to the work an irregular or chilled appearance. A sufficient interval of time should be allowed between each coat for the perfect evaporation of the solvent, whether alcohol, turpentine or oil. The time required for this depends partly upon the kind of varnish employed, and partly on the state of the atmosphere. Under ordinary circumstances, spirit varnishes generally require from two to three hours between every coat; turpentine varnishes mostly require six or eight hours; and oil varnishes still longer—sometimes as much as twenty-four hours. But whatever time may be required, the second layer should never be added until the first is permanently hard; as when one layer is defended from the air by a second, its drying is almost stopped, and it remains soft and adhesive.

In applying spirit varnish, some little tact and expedition are necessary, in order to spread the varnish uniformly over the surface before it becomes too much thickened by evaporation, or it will exhibit a very irregular surface when finished. If the surface does not exceed a few inches square, no material difficulty is experienced, as the whole may be brushed over two or three times before the varnish becomes too thick; but surfaces containing two or three square feet present much greater difficulty, as it is necessary that the varnish should be sufficiently worked with the brush to exclude all minute air-bubbles, which would spoil the appearance of the work, and can seldom be entirely removed until just before the varnish is becoming too thick to *flow* or spread uniformly after the brush has passed over it.

Turpentine and oil varnishes are applied in the same general manner as spirit varnishes; but as they dry more slowly, more time may be occupied in laying on the varnish, and therefore large surfaces may be more easily and uniformly covered; but the same precautions with respect to the dryness and warmth of the atmosphere are likewise desirable when it is wished to produce a brilliant surface.

Every precaution should also be taken to prevent any dust, or loose hairs from the brush, becoming accidentally attached to the varnish. Should this occur they will require to be carefully picked out with the point of a penknife and the surface of the varnish leveled with fine glass-paper, prior to the application of the next coat.

In using spirit varnishes, it is at all times of the first importance that particular attention should be given to doing the varnishing in a dry atmosphere; as all solutions of resins in alcohol are precipitated by the addition of water, not only as visible moisture, but even as vapor, which is at all times deposited by the atmosphere at a reduced temperature, in the form of invisible dew, and in this state it precipitates the resin in the thin coat of varnish, and gives the surface a milky, clouded or opaque appearance when the varnish is said to be chilled. But this effect is frequently produced even on a warm and apparently fine summer day, when the atmosphere happens to be more than usually charged with moisture. This is a frequent stumbling block in varnishing, and is only to be obviated by carrying on the process in a room sufficiently warmed to keep the moisture suspended in the air until the solvent has completely evaporated.

Not only should the room be sufficiently heated, but all currents of cold air must be avoided, as cold drafts if suffered to pass over the recently varnished surface, are quite sufficient to dull the varnish wherever they extend. When the varnish has been chilled, the brilliancy and clearness may frequently be restored by giving the chilled surface another thin coat of varnish, taking care to avoid the causes of the former failure, and immediately holding the varnished surface at a moderate distance from a fire, so as to warm it sufficiently to partially re-dissolve the chilled coat; but care is necessary to avoid heating the varnish so much as to raise blisters, in which case no remedy would remain but to scrape off the entire coat.

The temperature generally preferred for the varnish room is about 72 deg. F., but a few degrees more or less are not important.

Brushes for Varnishing.—For spirit varnishes, camel's-hair pencils and brushes are used, the sizes of which vary from one-quarter to three-quarters of an inch diameter, according to the size of the work. When the surfaces are very large, flat camel-hair brushes are used; but from their comparative thinness they scarcely contain a sufficient quantity of varnish to preserve the brush uniformly charged in passing over a large surface. Turpentine and oil varnishes require less delicacy; and flat brushes, made of fine soft bristles, are generally used, or sometimes ordinary painting brushes are employed, but they are rather harsh, and, owing to the adhesion of the varnish, the hairs are apt to be loosened, and come out. Brushes should always be kept perfectly soft and clean, and therefore should never be laid aside when through work, without cleaning. For this purpose turpentine is best; the brushes can either be washed out quite clean in it, dried on a cloth, and laid aside, or the bristles can be partially immersed in turpentine and allowed to remain in it until wanted for use. Warm water and soap will also serve to clean the brushes. If, however, the brushes are laid aside without being thoroughly cleaned, they will certainly be ruined by the hardening of the varnish.

Varnish Pan.—This can be procured at the color shops. It is constructed of tin, with a false bottom; the interval between the two bottoms is filled with sand, which being heated over the fire keeps the varnish fluid, and it flows more readily from the brush. There is a tin handle to it, and the false bottom slopes from one end to the other, which gives sufficient depth when the varnish is low. It should also have a wire fixed across the top to wipe the brush against. An ordinary preserve jar is frequently used for containing the varnish, and is sufficiently suitable; but it also should have a wire or string stretched across the top, for reducing the quantity of varnish taken up by the brush. The quantity of varnish poured into the jar should be sufficient to nearly cover the hairs of the brush in order to keep it soft. Too small a quantity of varnish is liable to thicken rapidly by evaporation, which should at all times be prevented as far as possible, by keeping the vessel closely covered when not in actual use.

RUBBING.

This part of the finishing process is that which gives to the varnish when laid upon the wood a degree of smoothness not otherwise attainable; for by the use of the brush alone, minute furrows and ridges are left upon the plastic surface of the varnish; and although good varnish possesses in itself a high gloss, the gloss is not nearly so agreeable to the eye as the brilliant polish, of which rubbing is the preliminary. The reduction of these ridges and furrows is accomplished by means of finely-powdered pumice-stone moistened with raw linseed oil, applied with a piece of hair-cloth or other coarse and fibrous material. For rubbing large flat surfaces the hair-cloth is sometimes folded over a block of convenient size, but this is not practicable for articles of small size or irregular shape. In rubbing, considerable force must be used, but the stroke should be steady and as long as possible, and great care should be taken to rub the surface uniformly, as in case it is rubbed unevenly the varnish is liable to be worn away quite to the wood in some places, and the perfect smoothness that is the beauty of a good finish will thus be impossible. The edges especially are liable to be rubbed bare, and should be carefully treated. The crevices and hollows of carvings are rubbed by means of hard pointed sticks of various convenient sizes. The rubbing should be continued until the entire surface appears perfectly smooth and free from marks of any kind. The surplus pumice-stone and oil should all be carefully removed from the surface by means of rags, and the work may then be cleaned up with a little sweet oil well rubbed in, and retouched with a cloth slightly dampened in alcohol, which serves to remove any remaining oil from the surface. If the article has veneered panels, they are now ready for the final processes of "polishing" or "flowing."

FLOWING AND POLISHING.

Flowing.—Flowing is the process of giving the work, after it has been properly prepared, a coat of varnish made expressly for that purpose, called flowing varnish. Veneered panels are usually

finished this way. Some finishers, when the body-work is to be dead-finish with flowed panels, coat the panels with the same varnish—shellac or other—used for the body, and rub them with pumice-stone and oil; in fact, up to the point of flowing make no difference whatever in the treatment of the body-work and the panels. Such treatment is not recommended; whatever varnish is used for the body-work, the panels should be coated with two or three coats of the best rubbing varnish; oil should not be used for rubbing, as, if the surface is at all greasy the subsequent coat of flowing varnish cannot be evenly laid, therefore water should be used with the pumice-stone for rubbing, in place of oil. After the rubbing is completed, wash off with a sponge and dry with a chamois skin. Let it stand for a day, and after freeing the work of all pumice-stone and dust, take it to the flowing-room, which should be clean, dry, and free from dust and all drafts of air, apply the varnish with a flat brush of suitable width made of badger or fitch hair; lay the varnish on smoothly and evenly, leaving no marks of the brush. The quicker the varnish is put on, and the less it is worked, the better it will look. Let it stand in the room until it is hard enough to handle. Upholstered work should not be flowed until it comes from the hands of the upholsterer and is ready for the warerooms.

Varnish Polishing.—This process is used when it is desired to give to the work a bright lustre, different from the natural gloss, and resulting from a perfectly smooth surface produced by rubbing. The previously applied coats of rubbing varnish having been rubbed down with pumice-stone and water, one or more coats of polishing varnish is applied, rubbed down as before, and brought to a bright mirror-like surface with rotten-stone and water. Clean up with a little sweet oil, and afterward with a cloth dampened in alcohol.

VARIETIES OF FINISH.

The processes of finishing having been described, it now remains to explain varieties of finishing in use; these are largely

derived from the peculiar qualities of the different varnishes used, for full explanation of which see article on VARNISHES. Polishing-varnishes, which are very hard and durable, are so called because their surface can be brought to a high lustre by rubbing with the proper materials. Flowing or finishing-varnishes contain more oil than polishing-varnishes, dry more slowly, and are softer, but their peculiar qualities are brilliancy and durability, fitting them for work requiring a brilliant gloss, such as veneered panels. Rubbing-varnishes are those that dry sufficiently hard to admit of being rubbed to a smooth surface. Turpentine varnishes, being the cheapest variety, are employed for cheap work, such as common chairs, bedsteads, etc. In general terms it may be said that the particular filler, stain or other preliminary application used exercises an important influence over the appearance of the finish, and that a great variety of combinations are possible. For different woods different fillers are used, the basis in most cases being the same, the difference being principally in the coloring material, and this is capable of great variation, to suit individual tastes. The same is true of stains, and under the head of STAINS and FILLERS will be found all needed information concerning the applications proper for different woods, with methods for using them. The varnish or other covering material used subsequently, will here be treated of separately.

Dead-Finish.—This term is applied to the finish produced by the reduction of any of the rubbing-varnishes with powdered pumice-stone and raw linseed oil (see RUBBING), the surface thus produced being left in the semi-lustrous state, by omitting the polishing process. It is now more used than any other for body work, shellac varnish being generally employed because of its adaptation to the requirements of fine cabinet work, and its properties of quick and hard drying. Copal, anime and amber varnishes are also used, but are slower drying. Veneered panels are usually "flowed" or "polished" when the body work is dead-finished. The number of coats required depends somewhat upon the quality of the filler, but usually three coats, and sometimes less, are amply sufficient.

Varnish Finish.—For cheap work.—One coat of filler or stain, followed by one coat of cheap turpentine varnish, without rubbing. In this class of work, the brilliancy of the gloss and covering qualities of the varnish are principally considered. The cheaper turpentine varnishes have a brilliant gloss, and dry very hard, but the gloss is not permanent, and after drying, the gum is very brittle and easily cracked and broken. The gum used is principally common resin.

Wax Finish.—Mix together with heat, white wax and spirits of turpentine to the consistency of thick paste; when cold, apply it to the work with a rag; rub on heavily so as to fill the pores of the wood; remove all wax from the surface with a wooden scraper made in the shape of a carpenter's chisel; smooth off with a bunch of soft rags by rubbing hard and quick for a few minutes; finish with a little French polish applied with a cotton pad. (See FRENCH POLISH). For table tops and all large flat surfaces, allow the wax to remain on and finish with a warm iron by passing it lightly and quickly over the work until the wax is made smooth and the surface is sufficiently polished. This is not considered a desirable finish, as it is not durable, and water spots it very easily.

Imitation Wax Finish.—Use the light-colored filler, named under the head of FILLERS. Apply three coats of white shellac; rub down with pumice-stone and oil; clean up with brown japan and spirits of turpentine mixed. Varnish-polish the panels.

Ebony Finish.—This finish is usually applied to cherry, or other light-colored woods having little grain. The ebony appearance is produced by the use of a stain, various receipts for which will be found under the head of STAINS. White shellac is the varnish usually employed, but some prefer the best rubbing-varnishes. Whatever varnish is selected, it should be as near as possible transparent, as otherwise the color of the work will appear to be greenish or brown. Not more than three coats should be applied, as successive coats of the most transparent varnish will cause an opaque or clouded appearance. Experience and care are re-

quired to successfully rub an ebonized article, as the varnish must be rubbed almost to the wood, and if rubbed too deep a portion of the stain is removed, leaving a spot. Especial care should be used in rubbing the angles. *Another.*—Instead of staining the wood and applying successive coats of transparent rubbing-varnish, a black varnish (or more properly speaking, a lacquer) is often laid upon the surface of the wood. This process possesses the advantage of being very speedy, not occupying more time than ordinary spirit-varnishing, but on the other hand, the rapid hardening of the gum prevents the varnish from entering into and becoming fixed in the pores, so that it lies in a thin, hard, but very brittle coating upon the surface, and is very readily broken and scaled off, leaving spots of the original color of the wood, that cannot be properly repaired. Shellac varnish is generally used for this finish, and is prepared by adding to it drop-black or perfectly pure lamp-black, containing no grease or other foreign substance, sufficient to make it perfectly black. Apply one or more coats of this to the work, and finish by adding the necessary number of coats of brown shellac, and rubbing in the usual way. This finish is employed when it is desired to engrave or carve a design through ebonized work, thus making the natural color of the wood appear in contrast to the black.

French Polishing.—This is a method of varnishing by rubbing the varnish upon the surface of the wood instead of applying it with brushes. When varnish is applied simply with a brush, a comparatively uneven surface results, rendering necessary the subsequent processes of rubbing and polishing, but by the method of French polishing, a smooth and continuous surface, hard and not easily scratched, is secured.

All the polishes are applied very much in the same way, and a general description will therefore be sufficient. To obtain a good polish with lac varnish on wood, the quantity applied must be very small, and must be rubbed continuously until dry. If the work be porous or cross grained, it will be necessary to give it a coat of thin, clear size previous to commencing with the polish; when dry,

the surface must be smoothed with fine glass or sand-paper. The size fills up the pores and saves the polish, and also saves considerable time in the operation.

Make a wad of cotton-batting, covered with several folds of very fine, soft linen cloth; put the wad or cushion to the mouth of the bottle containing the preparation (or polish) and shake it sufficiently to damp the cloth; then proceed to lightly rub the work with circular motion; as the rubber becomes drier, the pressure may be increased, but care should be taken not to press too heavily when the rubber contains much polish, as streakiness will result. The circular motion should be continued until the rubber becomes quite dry, when more polish may be taken upon it and the rubbing renewed. It should be borne in mind that the rubber should never be raised directly from the work, but should be raised with a sweeping motion; also that it should never for a moment remain quiet upon the surface; and that its motion should be as even as possible; neglect of these precautions will produce a rough surface wherever the rubber remains quiet or is improperly removed. The circular rubbing must be continued until the surface appears perfectly smooth and the pores are no longer visible. Be very particular to keep the cloth covering of the wad clean and soft; it is desirable to use a clean portion each time it is dipped in the polish. It is quite likely that in about twelve hours after the above operation the surface of the work will be lustreless, and the grain plainly visible, in that case proceed over the work again until the grain is thoroughly filled. French polishing is a process requiring particular care and skill, and considerable experience is necessary to produce good results.

The Ingredients.—Shellac, dissolved in alcohol, is the basis of all French polishes, and some finishers use thin shellac varnish without other admixture, slightly moistening the rubber with linseed oil to prevent stickiness and make it work smoothly. There is a great variety of admixtures and diversity in the proportion of ingredients, but the differences are not material. We subjoin a number of receipts.

The Genuine French-Polish.—To one pint of spirits of wine add a quarter of an ounce of gum-copal, a quarter of an ounce of gum-Arabic, and one ounce of shellac.

Let the gums be well bruised, and sifted through a piece of muslin. Put the spirits and the gums together in a vessel that can be closely corked; place them near a warm stove, and frequently shake them. In two or three days they will be dissolved. Strain the mixture through a piece of muslin, and keep it tight corked for use.

French Polish.—Take one ounce each of mastic, sandarac, seedlac, shellac, gumlac, and gum-Arabic; reduce them to powder; and add a quarter of an ounce of virgin wax; put the whole into a bottle, with one quart of rectified spirits of wine; let it stand twelve hours, and it will be fit for use.

Another.—Put into a glass bottle one ounce of gumlac, two drachms of mastic in drops, four drachms of sandarac, three ounces of shellac, and half an ounce of gum dragon; reduce the whole to powder; add it to a piece of camphor the size of a nut, and pour on it eight ounces of rectified spirits of wine. Stop the bottle close, but take care, when the gums are dissolving, that it is not more than half full. Place near a warm stove until dissolved.

Other French-Polish Receipts.—1 pint naptha, 3½ ounces orange shellac, ½ ounce elima. Darken with red saunders wood.

To one pint of spirits of wine, add half an ounce of gum shellac, half an ounce of seed lac, and a quarter of an ounce of gum sandarac; submit the whole to a gentle heat, frequently shaking it, till the various gums are dissolved, when it is fit for use.

Shellac, 6 ounces; naptha, 1 quart; sandarac, 1 ounce; benzoin, ¾ ounce.

Three ounces shellac, ½ ounce of gum mastic pulverized, and one pint of methylated spirits of wine added. Let it stand till dissolved.

Twelve ounces shellac, 2 ounces gum elima, 3 ounces gum copal, 1 gallon of spirits of wine; dissolve.

The following must be well mixed and dissolved:—Pale shellac, 2¼ pounds; 3 ounces mastic, 3 ounces sandarac, 1 gallon spirits

of wine. After the above is dissolved, add 1 pint copal varnish, 1¼ ounces shellac, ½ ounce gum juniper, ½ ounce benzoin, ½ pint of methylated alcohol.

An Improved Polish.—To a pint of spirits of wine add, in fine powder, one ounce seedlac, two drachms of gum guaiacum, two drachms of dragon's-blood, and two drachms of gum mastic; expose them, in a vessel stopped close, to a moderate heat for three hours, until you find the gums dissolved; strain the whole into a bottle for use, with a quarter of a gill of the best linseed oil, to be shaken up well with it.

This polish is more particularly intended for dark-colored woods—for it is apt to give a tinge to light ones, as satin-wood or air-wood, etc.—owing to the admixture of the dragon's-blood, which gives it a red appearance.

Water-proof Polish.—Take a pint of spirits of wine, two ounces of gum benzoin, a quarter of an ounce of gum sandarac, and a quarter of an ounce of gum anime; these must be put into a stopped bottle, and placed either in a sand-bath or in hot water till dissolved; then strain the mixture, and, after adding about a quarter of a gill of the best clear poppy oil, shake it well up, and put it by for use.

Prepared Spirits.—This preparation is useful for finishing after any of the foregoing receipts, as it adds to the lustre and durability, as well as removes every defect, of the other polishes; and it gives the surface a most brilliant appearance.

Half a pint of the very best rectified spirits of wine, two drachms of shellac, and two drachms of gum benzoin. Put these ingredients into a bottle, and keep it in a warm place till the gum is all dissolved, shaking it frequently; when cold, add two teaspoonfuls of the best clear white poppy oil; shake them well together, and it is fit for use.

This preparation is used in the same manner as the foregoing polishes; but, in order to remove all dull places, you may increase the pressure in rubbing.

Polish for Turners' Work.—Dissolve 1 ounce of sandarach in ½ pint of spirits of wine; shave 1 ounce of beeswax, and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste, add the former mixture to it by degrees; then, with a woollen cloth, apply it to the work while it is in motion in the lathe, and polish it with a soft linen rag; it will appear as if highly varnished.

STAINING.

Staining is the process of imparting to the surface of wood a color different from its natural one. It consists of two varieties, surface-staining and body-staining. In the former, as the name implies, the staining is effected by various compounds in the nature of pigments, laid upon the surface like paint, and forming a thin opaque coating, which does not, to any considerable degree, affect the fibre of the wood. In the latter the changes are chemical, the stain being usually applied as a thin wash, which, entering the pores of the wood, colors it to some depth below the surface. Staining requires no preliminary preparation, the stain being applied directly to the wood. As most stains raise the grain of the wood to a considerable extent, it is necessary before applying the varnish, to sand-paper the wood enough to render the grain quite smooth; this sometimes renders a second coat necessary, after which the sand-paper must be again applied.

A Good Black Stain.—1. Gall-nuts coarsely broken, 2 ounces; rain water, 1 quart; boil until reduced one-half. 2. White vinegar, 1 pint; iron filings, 2 ounces; antimony (powdered) 2 ounces; vitriol, 1 ounce; logwood, a small handful. Infuse in bottle eight days, tying the cork down. To stain a piece of wood, give the wood a coating of No. 1, which acts as a mordant; when nearly dry put on No. 2; let it dry quite, and then brush it over again with No. 2.

Another.—Boil ½ lb. of chip logwood in 2 quarts of water, add 1 oz. of pearl-ash, and apply it hot to the work with a

brush; then take ½ lb. of logwood, boil it as before in 2 quarts of water, and add ½ oz. of verdigris and ½ oz. of copperas; strain it off, put in ½ lb. of rusty steel filings, and with this go over the work a second time.

Another.—Boil the extract of logwood in water, and to it add slowly a little of the yellow prussiate of potash. Brush on hot.

Another.—Boil 1 lb. logwood in 4 quarts of water; add a double handful of walnut-peel or shells, boil it up again, take out the chips, add a pint of the best vinegar and it will be fit for use; apply hot. This will be improved by applying over the first stain a solution of one ounce of green copperas in a quart of water.

Other Black Stains.—1. Drop a little sulphuric acid into a small quantity of water; brush over the wood and hold it to the fire; it will be a fine black and receive a good polish. 2. For a beautiful black, on wood, nothing can exceed *black japan.* Apply two coats; after which, varnish and polish it. 3. To 1 gallon vinegar, add a quarter of a pound of iron rust; let it stand for a week; then add a pound of dry lamp-black, and three-quarters of a pound copperas; stir it up for a couple of days. Lay on five or six coats with a sponge, allowing it to dry between each; polish with linseed oil and a soft woollen rag, and it will look like ebony. 4. Vinegar, ½ gal.; dry lamp-black, ½ lb.; iron rust sifted, 3 lbs.; mix and let stand for a week. Lay three coats of this on hot, and then rub with linseed oil, and you will have a fine deep black. 5. Add to the above stain nut-galls, 1 oz.; logwood chips, ½ lb.; copperas, ¼ lb.; lay on three coats; oil well, and you will have a black stain that will stand any kind of weather, and is well adapted for ships' combings, etc. 6. Logwood chips, ½ lb.; Brazil-wood, ¼ lb.; boil for 1½ hours in 1 gallon water. Brush the wood with this decoction while hot; make a decoction of nut-galls, by gentle simmering for three or four days, a quarter of a pound of the galls in 3 qts. water; give the wood three coats, and, while wet, lay on a solution of sulphate of iron (2 ozs. to a quart), and, when dry, oil or varnish. 7. Give three coats with a solution of copper filings in aquafortis, and repeatedly brush over with the logwood decoction until the greenness

of the copper is destroyed. 8. Boil ½ lb. logwood chips in 2 quarts water; add an ounce of pearlash, and apply hot with a brush. Then take 2 quarts of the logwood decoction, and ½ oz. of verdigris, and the same of copperas; strain, and throw in ½ lb. of iron rust. Brush the work well with this, and oil.

Brown Stain.—Boil 1 lb. of the brown pigment called Terre de Cassel with 4 quarts of water, until it is reduced one-third. Mix two ounces (Troy) of white potash with sufficient water to dissolve it, and mix with the Terre de Cassel. This stain must be applied with a brush, two or even three times, according to the depth of the shade required.

Walnut Stain.—Mix together, by stirring, 1 quart spirits of turpentine, 1 pint asphaltum varnish, 1 pint of japan, 1 lb. dry burnt umber, 1 lb. dry Venetian red; apply with a brush. This stain is transparent, and allows the grain of the wood to show through.

Another.—Boil 1½ ounces washing-soda, and ¼ ounce bichromate of potash, in 1 quart of water; add 2½ ounces Vandyke brown. This stain may be used either hot or cold.

Another.—With a brush apply a thin solution of permanganate of potassa in water, until the desired color is produced, allowing each coat to dry before another is applied.

Oak Stain.—Add to a quart of water 2 ounces each of potash and pearlash. This is a very good stain, but it should be used carefully as it blisters the hands and softens brushes. The stain may be made lighter by adding more water.

Other Oak Stains.—To darken the color of oak any of the following may be used:

Liquid ammonia laid on evenly with a rag or brush will deepen the color immediately, and it will not fade, this being an artificial production of result produced naturally by age.

Bichromate of potash, dissolved in cold water, and applied with a brush, will produce a similar result.

A decoction of green walnut-shells will bring new oak to any shade or nearly black.

Rosewood Stain.—Mix in a bottle ¼ lb. of extract of logwood, 1 oz. salts of tartar, and 1 pint of water; in another bottle, put 1 lb. of old iron in small pieces, and 1 pint of vinegar, which, after standing twenty-four hours, will be ready for use; make a hard stiff brush with a piece of rattan sharpened at one end in a wedge shape, pounding it so as to separate the fibre. Mix in 1 pint of varnish, ¼ lb. of finely-powdered rose-pink. The materials are now ready, and the first thing in the process is to stain the wood with the logwood stain; give two coats of this, allowing the first to become nearly dry before applying the second; then dip the rattan brush in the vinegar, and with it form the grain, after which give the work a coat of the varnish and rose pink. There can be no definite directions given for graining, except to study the natural wood and imitate it as near as possible. With the above materials skilfully applied, any common wood can be made to resemble rosewood so nearly that it will take a good judge to distinguish the difference.

Another.—Boil 1 lb. of logwood in 1 gallon of water, add a double handful of walnut shells, boil the whole again, strain the liquor and add to it 1 pint of the best vinegar. It is then ready for use. Apply it boiling hot, and when the wood is dry, form red veins in imitation of the grain of rosewood with a brush dipped in the following solution: Nitric acid, 1 pint; metallic tin, 1 oz.; sal ammoniac, 1 oz. Mix and set aside to dissolve, occasionally shaking.

Cherry Stain.—Mix together, by stirring, 1 quart of spirits of turpentine, 1 pint of varnish, and 1 lb. of dry burnt sienna; apply with a brush, and after it has been on about five minutes wipe it off with rags. This stain takes about 12 hours to dry.

Another Cherry Stain.—Take 1 quart alcohol, 2 ozs. of dragon's-blood; pulverize the latter along with ¼ oz. of alkanet root; mix, and let stand in a warm place a couple of days. Shake frequently in the meantime. Apply with a sponge or brush. Two or three coats may be required. This makes a fine stain.

Red Stain FOR COMMON WORK.—Archil will produce a very

good stain of itself when used cold, but if after one or two coats have been applied and suffered to get almost dry, it is brushed over with a hot solution of pearlash in water, it will improve the color.

Mahogany Stain.—To darken mahogany, apply a weak solution of bichromate of potash in water. Apply successive coats, allowing each to dry, until the required shade is secured.

Surface Stains.—The following are for the most part used to apply to woods of inferior quality, to make them resemble choicer woods. The colors are all to be mixed with very thin glue size, laid on warm with a soft woollen material, and the wood wiped dry after application. All the colors used in staining should be well pulverized, and before use the liquid should be strained.

Imitation Oak Stain.—Equal parts burnt umber and brown ochre.

Imitation Mahogany Stain.—One part Venetian red and two parts yellow lead.

Imitation Rosewood Stain.—Venetian red, darkened with lamp-black to required shade.

Imitation Walnut Stain.—Burnt umber and yellow ochre, mixed in proportions to give desired shade.

Fine Crimson Stain.—Boil 1 lb. of good Brazil dust in 3 quarts of water for an hour; strain it, and add ½ oz. of cochineal; boil it again gently for half an hour, and it will be fit for use.

If you will have it more of a scarlet tint, boil half an ounce of saffron in a quart of water for an hour, and pass over the work previous to the red stain.

Purple Stain.—To 1 lb. of good chip logwood put 3 quarts of water; boil it well for an hour; then add 4 ozs. of pearlash, and 2 ozs. of indigo pounded.

Fine Blue Stain.—Into 1 lb. of oil of vitriol (sulphuric acid) in a clean glass phial, put 4 ozs. of indigo, and proceed as above directed in dyeing purple.

Fine Green Stain.—To 2 pints of the strongest vinegar,

add 4 ozs. of the best verdigris pounded fine, ½ oz. of sap green, and ½ oz. of indigo.

Distilled vinegar, or verjuice, improves the color.

Yellow Stain.—Dissolve ¼ lb. tumeric in 1 pint alcohol; let it stand until the tumeric settles to the bottom.

Another.—A small piece of aloes added to the varnish will have all the effect of a bright yellow stain.

To Brighten Stains.—Any of the stains named (except the surface stains) will be rendered much more brilliant by an application of the following: 1 oz. nitric acid, ½ teaspoonful muriatic acid, ¼ oz. grain tin, 2 ozs. rain water. Mix in a bottle, at least two days before using, and keep the bottle well corked.

DYEING WOOD.

Dyeing wood is mostly applied for the purpose of veneers, while staining is more generally had recourse to to give the desired color to the article after it has been manufactured. In the one case, the color should penetrate throughout, while in the latter the surface is all that is essential.

In dyeing, pear-tree, holly and beech, take the best black; but for most colors, holly is preferable. It is also best to have wood as young and as newly cut as possible. After the veneers are cut, they should be allowed to lie in a trough of water for four or five days before they are put into the copper; as the water, acting as a purgative to the wood, brings out an abundance of slimy matter, which must be removed, or the wood will never be a good color. After this purificatory process, they should be dried in the open air for at least twelve hours. They are then ready for the copper. By these simple means the color will strike much quicker, and be of a brighter hue. It would also add to the improvement of the colors, if, after the veneers have boiled a few hours, they are taken out, dried in the air, and again immersed in the coloring copper. Always dry veneers in the open air, for fire invariably injures the colors.

Fine Black Dye.—Put 6 lbs. of chip logwood into the copper, with as many veneers as it will conveniently hold, without pressing too tight; fill it with water, and let it boil *slowly* for about three hours; then add half a pound of powdered verdigris, half a pound of copperas, and 4 ounces of bruised nut-galls; fill the copper up with vinegar as the water evaporates; let it boil gently two hours each day till the wood is dyed through.

Another.—Procure some liquor from a tanner's pit, or make a strong decoction of oak bark, and to every gallon of the liquor add a quarter of a pound of green copperas, and mix them well together; put the liquor into the copper, and make it quite hot, but not boil; immerse the veneers in it, and let them remain for an hour; take them out, and expose them to the air till it has penetrated its substance; then add some logwood to the solution, place the veneers again in it, and let it simmer for two or three hours; let the whole cool gradually, dry the veneers in the shade, and they will be a very fine black.

Fine Blue Dye.—Into a clean glass bottle put 1 lb. of oil of vitriol, and 4 ozs. of the best indigo pounded in a mortar (take care to set the bottle in a basin or earthen glazed pan, as it will ferment); then put the veneers into a copper or stone trough; fill it rather more than one-third with water, and add as much of the vitriol and indigo (stirring it about) as will make a fine blue, which may be known by trying it with a piece of white paper or wood. Let the veneers remain till the dye has struck through.

The color will be much improved if the solution of indigo in vitriol be kept a few weeks before using it. The color will strike better if the veneers are boiled in plain water till completely soaked through, and then allowed for a few hours to dry partially, previous to being immersed in the dye.

Another.—Throw pieces of quicklime into soft water; stir it well; when settled, strain or pour off the clear part; then to every gallon add ten or twelve ounces of the best turnsole; put the whole into the copper with the veneers, which should be of white holly, and prepared as usual by boiling in water; let them simmer

gently till the color has sufficiently penetrated, but be careful not to let them boil in it, as it would injure the color.

A Fine Yellow Dye.—Reduce 4 lbs. of the root of barberry, by sawing, to dust, which put in a copper or brass trough; add 4 ozs. of turmeric and 4 gallons of water, then put in as many white holly veneers as the liquor will cover; boil them together for three hours, often turning them; when cool, add 2 ozs. of aquafortis and the dye will strike through much sooner.

A Bright Yellow Dye.—To every gallon of water necessary to cover the veneers, add 1 lb. of French berries; boil the veneers till the color has penetrated through; add to the infusion of the French berries, the liquid for brightening colors given on page 43, and let the veneers remain for two or three hours, and the color will be very bright.

Bright Green Dye.—Proceed as in either of the previous receipts to produce a yellow; but instead of adding aquafortis or the brightening liquid, add as much vitriolated indigo (see page 44) as will produce the desired color.

Green Dye.—Dissolve 4 ozs. of the best verdigris, and of sap-green and indigo half an ounce each, in 3 pints of the best vinegar; put in the veneers, and gently boil till the color has penetrated sufficiently.

The hue of the green may be varied by altering the proportion of the ingredients; and it is advised, unless wanted for a particular purpose, to leave out the sap-green, as it is a vegetable color very apt to change, or turn brown, when exposed to the air.

Bright Red Dye.—To 2 lbs. of genuine Brazil dust, add 4 gallons of water; put in as many veneers as the liquor will cover; boil them for three hours; then add 2 ozs. of alum, and 2 ozs. of aquafortis, and keep it lukewarm until it has struck through.

Red Dye.—To every pound of logwood chips, add 2 gallons of water; put in the veneers, and boil as in the last; then add a sufficient quantity of the brightening liquid (see page 43) till you see the color to your mind; keep the whole as warm as the finger can be borne in it, till the color has sufficiently penetrated.

The logwood chips should be picked from all foreign substances, with which it generally abounds, as bark, dirt, etc.; and it is always best when fresh cut, which may be known by its appearing of a bright-red color; for if stale, it will look brown, and not yield so much coloring matter.

Purple Dye.—To 2 lbs. of chip logwood and half a pound of Brazil dust, add 4 gallons of water, and after putting in the veneers, boil them for at least three hours; then add 6 ozs. of pearlash and 2 ozs. of alum; let them boil for two or three hours every day, till the color has struck through.

The Brazil dust only contributes to make the purple of a more red cast; you may, therefore, omit it, if you require a deep bluish purple.

Another.—Boil 2 lbs. of logwood, either in chips or powder, in 4 gallons of water, with the veneers; after boiling till the color is well struck in, add by degrees vitriolated indigo (see page 44) till the purple is of the shade required, which may be known by trying it with a piece of paper; let it then boil for one hour, and keep the liquid in a milk-warm state till the color has penetrated the veneer. This method, when properly managed, will produce a brilliant purple, not so likely to fade as the foregoing.

Liquid for Brightening AND SETTING COLORS.—To every pint of strong aquafortis, add 1 oz. of grain tin, and a piece of sal-ammoniac of the size of a walnut; set it by to dissolve, shake the bottle round with the cork out, from time to time: in the course of two or three days it will be fit for use. This will be found an admirable liquid to add to any color, as it not only brightens it, but renders it less likely to fade from exposure to the air.

Orange Dye.—Let the veneers be dyed by either of the methods given in page 45, of a fine deep yellow, and while they are still wet and saturated with the dye, transfer them to the bright red dye as in page 45, till the color penetrates equally throughout.

Silver Gray Dye.—Expose to the weather in a cast-iron pot of six or eight gallons, old iron nails, hoops, etc., till covered with rust: add 1 gallon of vinegar and 2 of water, boil all well for

an hour; have the veneers ready, which must be hard-wood (not too dry), put them in the copper used to dye black, and pour the iron liquor over them; add 1 lb. of chip logwood and 2 ozs. of bruised nut-galls; then boil up another pot of the iron liquor to supply the copper with, keeping the veneers covered, and boiling two hours a day, till the required color is obtained.

Gray Dye.—Expose any quantity of old iron, or what is better, the borings of gun-barrels, etc., in any convenient vessel, and from time to time sprinkle them with spirits of salt (muriatic acid) diluted in four times its quantity of water, till they are very thickly covered with rust: then to every six pounds add a gallon of water, in which has been dissolved two ounces of salt of tartar; lay the veneers in the copper, and cover them with this liquid; let it boil for two or three hours till well soaked, then to every gallon of liquor add a quarter of a pound of green copperas, and keep the whole at a moderate temperature till the dye has sufficiently penetrated.

GILDING, SILVERING AND BRONZING.

Gilding, Silvering and Bronzing are processes of applying to previously prepared surfaces a thin layer of gold or silver leaf, or in bronzing, of a fine powder, prepared from various metals and intended to imitate the peculiar appearance of genuine bronze. The processes of gilding and silvering being identical, the description of one will suffice to explain the other.

Gilding.—Gold leaf, applied to articles of furniture as a means of decoration, is used in two ways; it is applied over an ordinary varnish or other finish, in which case but little special preparation is necessary; or, as when used for picture frames, cornices, etc., it is applied to a specially prepared foundation, the basis of which is whiting, mixed with various other ingredients suggested by experience or fancy. In either case, the gold leaf is caused to adhere to the work, by size specially prepared for the purpose, receipts for which follow herewith; the size being first applied to the

work, and when it has become of the right consistency, the gold is laid upon it. OIL-GILDING and BURNISH-GILDING are different methods used to obtain certain desired effects, the former principally for articles exposed to the weather, and for heightening the effect of incised carving or engraving, and the latter for picture-frames and articles having a specially prepared foundation, whose entire surface is to be gilded. It is intended that the gold shall adhere to the work only in the places to which the size has been applied, but the smallest portion of oil or even a slight dampness may cause the gold to partially adhere to the adjoining surface, resulting in slightly ragged edges; to prevent this, before applying the size to the desired design, the entire surface is covered with a thin film of some substance perfectly free from moisture, and easily removable by water, after completion of the process. Directions regarding this preliminary process are given under the caption: To PREVENT GOLD ADHERING.

The Requisites.—First, a sufficient quantity of leaf-gold, which is of two sorts—the deep gold, as it is called, and the pale gold. The former is the best; the latter very useful, and may occasionally be introduced for variety or effect.

Second, a gilder's cushion: an oblong piece of wood, covered with rough calf-skin, stuffed with flannel several times doubled, with a border of parchment, about four inches deep, at one end, to prevent the air blowing the leaves about when placed on the cushion.

Thirdly, a gilding-knife, with a straight and very smooth edge, to cut the gold.

Fourthly, several camel-hair pencils in sizes, and tips, made of a few long camel's hairs put between two cards, in the same manner as hairs are put into tin cases for brushes, thus making a flat brush with a very few hairs.

Lastly, a burnisher, which is a crooked piece of agate set in a long wooden handle.

Sizes.—These are of two kinds: oil sizes are those which when applied, present an adhesive surface, requiring the immediate

laying of the gold-leaf upon it; of this class is the oil-size commonly used in decorating furniture; water-sizes are those that are allowed to become dry and hard when applied, and are rendered adhesive when the gold is to be laid, by brushing over with water; for burnish-gilding these are always employed, as oil-size does not dry sufficiently hard to permit of burnishing.

Oil-Size for Oil-Gilding.—Grind calcined red-ochre with the best and oldest drying-oil. When desired for use, add sufficient oil of turpentine to make it work freely.

Parchment-Size.—For preparing Frames, etc.—To half a pound of parchment shavings, or cuttings of white leather, add three quarts of water, and boil it in a proper vessel till reduced to nearly-half the quantity; then take it off the fire, and strain it through a sieve. Be careful in the boiling to keep it well stirred, and do not let burn.

Gold-Size for Burnish-Gilding.—Grind fine sal-ammoniac well with a muller and stone; scrape into it a little beef suet, and grind all well together; after which, mix in with a pallet-knife a small proportion of parchment-size with a double proportion of water. When about to use, add parchment-size until it will just flow from the brush.

Another.—Grind a lump of tobacco-pipe clay into a very stiff paste with thin size; add a small quantity of ruddle and fine black lead, ground very fine, and temper the whole with a small piece of tallow. When ready to use, reduce with parchment-size until it will just flow from the brush.

Another.—Grind separately in water, 1 lb. Armenian bole, 2 ozs. red lead, a sufficient quantity of black lead; mix, and regrind with a small quantity of olive oil. Reduce with parchment-size to the proper consistency.

To Prevent Gold Adhering.—Either one of the following methods will prevent gold-leaf or bronze from adhering to the surface beyond the outlines of the sizing laid on to receive it:

1. Whiting used dry, and applied by means of a pounce bag.
2. Whiting mixed in water, and applied with a soft brush.

When the water has evaporated, dust off the superfluous whiting with an ordinary paint duster. By this method a very thin coating of whiting remains, which is free from any grittiness. One advantage gained by the use of whiting thus applied is, it furnishes a whitish ground over which clear varnish or oil-size may be distinctly seen as the striping progresses. After the leaf or bronze has been applied, the work must be carefully washed, so as to insure the removal of the whiting.

3. White of egg reduced with water, and applied with a piece of sponge.

4. A thin wash of starch water, either brushed on with a flat camel-hair brush, or applied with a soft sponge.

5. Take ball liquorice and water, a weak solution, and apply with a soft brush. This may be kept in a bottle ready for use at any time.

6. Cut a new potato in two, and rub over the part to be sized with the raw face exposed, allowing the juice to remain until dry.

It will be observed that any substance which interposes a film over the varnish, itself being free from tackiness and readily removed by water, will answer the purpose.

Oil Gilding.—Applying the Gold.—If the wood to be gilded is finished with varnish or otherwise, no additional foundation is necessary upon which to lay the gold-leaf; if the wood is not finished, after it has been smoothed and dusted, give it one or two coats of parchment size, after it is perfectly dry and hard, again smoothing the surface with fine sand-paper. That the gold may not adhere to any part of the work except where the size is hard, powder the surface lightly with whiting from a pounce-bag, which is a small bag made of material sufficiently loose to permit the powdered whiting to sift through as fine dust; if preferred, any of the preceding receipts for that purpose can be used instead. Remove the surplus whiting with the dusting-brush, and the work is then ready for the size. Apply this with a sable or fit brush of the proper size, carefully observing to make the outer lines of the design clear and sharp, that the work may not appear ragged. Let the size remain until it feels tacky, when the gold may be ap-

plied. This is the most difficult part of the operation, and experience is necessary before gold-leaf can be laid smoothly without a wrinkle or a break. Turn a leaf of gold out of the book upon the cushion; breathe gently upon the centre of the leaf and it will lay flat on the cushion; cut it to the proper size by bringing the knife perpendicularly over it, and sawing it gently until divided. Take your tip (a brush used for the purpose) and after drawing it lightly over your hair to remove any particles or dust that may be upon it, breathe upon it gently, which will dampen it sufficiently to cause the leaf of gold to adhere to it; lay the tip upon the leaf of gold and carefully transfer it to the work; blow upon it gently and it will straighten out and adhere. It may be rendered quite smooth by slightly dabbing it with a bit of cotton. In about an hour wash off the superfluous gold from the edges, with a sponge and water. If the article is to be exposed to the weather or much wear, the gilding may be varnished with copal varnish.

Burnish-Gilding.—As previously stated, this process requires a specially prepared foundation upon which to lay the gold, and as the preparation of this foundation is a distinct trade, the furniture dealer or cabinet-maker seldom finds it necessary to undertake it, the articles coming to his hand ready-prepared for gilding; but as in repairing picture-frames, cornices, mirror frames, etc., it frequently becomes necessary to renew the foundation, a comprehensive description of the whole process is given.

Preparing the Wood-work.—After smoothing and dusting the work, coat the frames in every part with boiling-hot parchment-size, as previously described, then mix a sufficient quantity of whiting with size to the consistency of thick cream, and with it by means of a brush, coat every part of the frame several times, permitting each coat to become perfectly dry before proceeding with the next. The wood will thus be covered with a layer of hard whiting nearly or quite a sixteenth of an inch in thickness. The size must not be too thick, and when mixed with the whiting should not be so hot as the preliminary coat of size.

Polishing.—When the prepared frames are quite dry, clean and polish them. To do this, wet a small piece at a time, and, with a smooth, fine piece of cloth, dipped in water, rub the part till all the bumps and inequalities are removed; and for those parts where the fingers will not enter, as the mouldings, etc., wind the wet cloth round a piece of wood, and by this means make the surface all smooth and even alike.

Where there is carved work, etc., it will sometimes be necessary to bring the mouldings to their original sharpness by means of chisels, gouges, etc., as the preparation will be apt to fill up all the finer parts of the work, which must be thus restored. It is sometimes the practice, after polishing, to go over the work once with fine yellow or Roman ochre; but this is rarely necessary.

Applying the Size.—Select the proper gold size from the receipts previously given; add parchment size until it will just flow from the brush; make it quite hot, and apply it to the work with a very soft brush, taking care not to make the first coat too thick; let it dry and give two or three successive coats, after the last brushing it with a stiff brush to remove any inequalities. The work is then ready for the gold.

Laying the Gold.—The manipulation of the gold-leaf has been described under the heading OIL-GILDING. In the process now being described, the size used (being water-size, which as previously explained is permitted to become hard and dry after being applied) must be moistened to cause the gold-leaf to adhere to it. For this purpose, with a long-haired camel-hair pencil, dipped in water, go over as much of the work as you intend the piece of gold to cover; then lay the gold upon it in the manner previously explained. Be sure that the part to which the gold is applied is sufficiently wet; indeed it must be floating, or the gold will be apt to crack. Proceed in this manner a little at a time, and do not attempt to cover too much at once, until by experience you are able to handle the gold with freedom. In proceeding with the work, if any flows or cracks appear, immediately apply a portion of gold sufficient to cover them. Sometimes when the gold does not

appear to adhere sufficiently tight, it will be necessary to draw a pencil quite filled with water close to the edge of the gold, that the water may run underneath it and soften the size.

Burnishing. - When the work is covered with gold, set it by to dry; there is a particular state or degree of dryness, known only by experience in which the moulding is in a fit state for burnishing; it will probably be ready to burnish in about eight or ten hours, but it will depend on the warmth of the room or state of the air.

When it is ready, those parts intended to be burnished must be dusted with a soft brush; then wiping the burnisher with a piece of soft wash-leather (quite dry) begin to burnish about an inch or two in length at a time, taking care not to bear too hard, but with a gentle and quick motion, applying the tool until all the parts of the surface are equally bright.

Matting or Dead Gold.—Certain portions only of the work are burnished, according to the fancy, and the facility with which the burnishing-tool can be applied; the remaining parts are now to be deprived of their metallic lustre, to make a more effective contrast with the burnishing. The parts thus treated are said to be matted or dead-gold. The process is as follows:

Grind some vermilion or yellow ochre very fine, and mix a very small portion either with the parchment size or with the white of an egg, and with a very soft brush lay it evenly on the parts to be dulled; if well done, it will add greatly to the beauty of the work. Previous to matting, the work must be well cleared of superfluous gold, by means of a soft brush.

Finishing.—In elaborate works it is frequently impossible to lay gold-leaf into all the intricacies of an elaborate design, and the parts thus left bare must be finished by touching up with a small brush charged with shell-gold, or gold-powder, mixed with gum-Arabic to the proper consistency. The following receipt describes the preparation of shell-gold:

Shell Gold.—Take any quantity of leaf-gold and grind it with a small portion of honey, to a fine powder, add a little gum-

Arabic and sugar-candy, with a little water, and mix it well together; let it dry.

Silver Size.—Grind pipe-clay fine with a little black-lead and good soap, and add parchment-size as directed for gold-size.

Composition for Frame Ornaments.—The ornaments for gilded mirror-frames, etc., are usually moulded from some plastic substance that is somewhat tougher and more durable than the ordinary gilding foundation of whiting and size. The proper moulds being prepared they are thoroughly rubbed upon the inside with sweet oil, and the composition firmly pressed in; after removing the mould the cast may be dried by a gentle heat, or while still plastic it can be applied in its proper place and bent into any position. Following are receipts for composition:

Dissolve 1 lb. of glue in 1 gallon of water. In another kettle boil together 2 lbs. of resin, 1 gill of Venice turpentine, and 1 pint of linseed oil; mix altogether in one kettle, and boil and stir till the water has evaporated. Turn the whole into a tub of finely-rolled whiting, and work it till it is of the consistency of dough.

Boil 7 lbs. of best glue in 7 half-pints of water. Melt 3 lbs. of white resin in 3 pints of raw linseed oil. When the above has been well boiled put them into a large vessel and simmer them for half an hour, stirring the mixture and taking care that it does not boil over. The whole must then be turned into a box of whiting rolled and sifted, and mixed till it is of the consistency of dough.

To Manipulate Gold Leaf.—Get a piece of paper, thin enough to show shadow of gold-leaf through, slightly wax it, lay it on gold-leaf, the latter will then adhere, and can be easily worked, and will come off clean. The paper should be slightly larger than the gold-leaf, and the fingers passed over the paper to make the gold-leaf adhere.

Bronzing.—This is a process for imitating on metal, plaster, wood, or other material, the peculiar appearance produced by chemical action upon the surface of bronze metal. It is accomplished by spreading over the surface of the material to be orna-

mented a very thin coating of bronze-powder, which is caused to adhere either by applying it directly upon a coating of any of the sizes mentioned in the foregoing pages, or by mixing with a vehicle, such as gum-Arabic or transparent varnish. The latter is most desirable, as in the other case, being subject to the direct action of the atmosphere, the bronze-powder soon tarnishes. In ornamenting furniture, bronzing is generally employed to represent gilding, a variety of bronze called gold-bronze being used, which affords an excellent imitation but is not very lasting. It is usually applied after the completion of the other finishing processes, the groundwork being prepared in the manner described under OIL-GILDING, and the size likewise applied as there described. A small wad of cotton-batting is then dipped in the bronze and passed gently over the sized portions, causing the bronze to adhere. In the other method—that of applying the bronze by means of a vehicle—the preliminaries of whiting the ground and sizing are not necessary, a small quantity of bronze being simply mixed with the vehicle employed to such a degree of fluidity that it will flow easily, and in that condition applied with a fine brush. Many preparations are used as vehicles, such as transparent varnish thinned with turpentine, gum-Arabic dissolved in water, and gold-size reduced with parchment-size. There are a variety of colors in bronze-powders, and to produce the best effect the size or vehicle should be of a color similar to that of the bronze used; in gold-size the coloring pigment is ochre, and in its place, for green-bronze, red-bronze, or blue-bronze, may be employed respectively verditer, vermilion or Prussian blue, a very small quantity being sufficient. In bronzing on painted work the ground should be as nearly as possible the color of the bronze to be applied.

GRAINING AND COLOR WORK.

Graining.—This is a variety of painting by which the grain, color or texture of different woods is imitated. Considerable experience is necessary to produce satisfactory results, the mixing of the colors to the right shade, and the manipulation of the

simple tools in a manner to faithfully imitate the grain and markings of the wood, requiring a high degree of skill. Of course these remarks do not apply to that variety of graining in which only a variegated surface is aimed at, and no pretensions made to a close imitation of any wood; that simple process requires neither skill nor judgment.

The peculiar effect of graining is produced by the use of several shades of paint, the lightest being first applied; the design being drawn by wiping off a certain portion of the second and third or darker coats, while still in a moist condition, the intermediate and light shades below are partially uncovered, the contrast of the different shades resembling the effect of the more prominent markings of the grain of wood. This resemblance is heightened by processes called "stippling" and "blending" which, as indicated by their titles, blend the shades and soften the lines.

The tools required are a stippling-brush, which is a brush with hairs about six or eight inches long; a kalsominer's brush will answer the purpose; a blending-brush, which is made from camel's or badger's hair and is very soft; two or three steel combs of different sizes; a rubber like a pencil-rubber, about the size of the thumb and rounded off at the ends, to convenient size.

The Process of Graining.—If there are any knots or sappy places in the article, they should be covered with one or two coats of glue-size or parchment-size to prevent them showing through. The work is then ready for the paint, three different shades being necessary. These are called the ground-color; the stippling color; and the graining or oil-color, and they are laid in the order named. An infinite number of combinations of colors are possible, obtained by the use of various coloring pigments in the different coats, and no two grainers agree as to the precise proportion of the ingredients to be used in imitating different woods; we give a number of receipts for graining grounds, and also for mixing various colors; the learner can vary the proportions to suit his taste as experience dictates, and to suit the work in hand. The ground color is used to represent the lightest part of the grain of the wood, the stippling color the intermediate shades, and the

graining color the darkest parts; a close study of natural woods will therefore be necessary to determine the color and depth of each.

The proper ground being selected (see GRAINING GROUNDS) apply one or more coats—as many as are necessary to thoroughly cover the surface. As soon as the ground color is hard the stippling coat may be applied. This is prepared by mixing the dry pigments without oil, with either very thin gum-water, stale beer, or vinegar containing a small portion of dissolved fish-glue. The pigments to be used, as stated above, are usually about the same as those used for the ground color, but of different proportions to produce a deeper shade. Apply the stippling color, and before it dries beat it softly with the side of the stippler, the long elastic hairs of which, disturbing the surface of the laid coat, cause the lighter coat beneath to become indistinctly visible, and produce the effect of the pores of wood. Next apply the graining color; as soon as it is laid, take the rubber and with it wipe out the larger veins to be shown, after each stroke wiping the paint from the rubber with a cloth held in the other hand for that purpose. Some grainers use a small sponge for veining, and others a small piece of cloth over the thumb, but the rubber is probably the most convenient. When the veins have been put in, to imitate as closely as possible the markings of natural wood, the various steel combs are brought into use, and the edges of the veins, and sometimes other portions of the work, combed with them, to soften the abrupt transition from the dark to the lighter shades. The blender is also now brought into use, and wherever the work may require it, the colors are still more softened and blended by its soft hairs. When too much color has been removed in veining, or when a certain figure, such as a knot, is required, the work is touched up with a fine brush, and again softened with the blender. When dry a coat of transparent varnish should be applied, having considerable oil to render it durable, as grained work is frequently washed.

Ready made graining colors are recommended as best and cheapest.

Graining Grounds.—Subjoined are a few recipes for mixing ground colors.

Light Wainscot Oak.—White lead and yellow ochre, mixed to the required tint. Some grainers prefer a perfectly white ground for very light oak for inside work, but it is always difficult for any but a perfect master of the art to proceed satisfactorily on a white ground, and the work, when completed, is apt to have a chalky effect, even though a dark varnish be applied.

A Darker Wainscot Oak.—Mix white lead, middle chrome, and yellow ochre.

Dark Oak.—White lead, Venetian red, and yellow ochre.

Very Dark Oak.—White lead, raw sienna, burnt umber, and Venetian red; or burnt and raw sienna, white lead, and burnt umber.

These colors, mixed in different proportions, will produce a multiplicity of tints suitable to receive the graining color, their strength being of course determined by the greater or lesser preponderance of white lead.

Mahogany Grounds.—There are various notions extant amongst grainers as to the best grounds for mahogany graining, some preferring a ground of a deep yellow cast, while others choose one approaching a bright red. The reds and yellows used are Venetian red, red lead, vermilion, raw sienna, burnt sienna, orange chrome, middle chrome, etc. These colors can be mixed to the tint required, an addition of white lead being made in each case, as the positive reds and yellows are too powerful unless diluted in turn by white. Venetian red, orange chrome, and white lead are the colors most generally used, and these three will, according to their predominance or subordination, make such a variety of tints that the most fastidious grainer need have no misgiving that the result will not come up to his expectation, if he exercise due discretion in mixing the colors.

Rosewood Ground.—Venetian red, vermilion, and white lead. A little scarlet lake is added for superior work, but this of course is too expensive for general use. Some painters mix with the reds a small quantity of raw sienna or chrome yellow.

Bird's-Eye Maple.—White lead alone is preferred by some grainers, but the majority of painters use a little yellow ochre to kill the rawness of the white, and this is much the better plan to adopt. Beginners are apt to make the ground too yellow, a mistake that should be avoided at the outset, as the varnish which has subsequently to be coated over the work will give transparency, and add a pale creamy tone, whereas, if the ground be too yellow, the result will be heaviness.

Spirit Graining for Oak.—Two pounds of whiting, quarter of a pound of gold size, thinned down with spirits of turpentine; then tinge your whiting with Vandyke brown and raw sienna, ground fine. Strike out your lights with a fitch dipped in turpentine, tinged with a little color to show the lights. If your lights do not appear clear, add a little more turpentine. Turpentine varnish is a good substitute for the above mentioned. This kind of graining must be brushed over with beer, with a clean brush, before varnishing. Strong beer must be used for glazing up top-graining and shading.

Oil for Graining Oak.—Grind Vandyke brown in turpentine, add as much gold-size as will set, and as much soft soap as will make it stand the comb. Should it set too quickly, add a little boiled oil. Put a teaspoonful of gold-size to half a pint of turpentine, and as much soap as will lie on a twenty-five cent piece, then take a little soda mixed with water and take out the veins.

To Prepare the Ground for Oak Rollers.—Stain your white lead with raw sienna and red lead, or with chrome yellow and Venetian red; thin it with oil and turps, and strain for use. When the ground work is dry, grind in beer, Vandyke brown, whiting and a little burnt sienna, for the graining color; or you may use raw sienna with a little whiting, umbers, etc.

To Imitate Old Oak.—To make an exceedingly rich color for the imitation of old oak, the ground is a composition of stone ochre or orange chrome and burnt sienna; the graining color

is burnt umber or Vandyke brown, to darken it a little. Observe that the above colors must be used whether the imitation is in oil or distemper. When dry, varnish.

To Imitate Old Oak, in Oil.—Grind Vandyke and whiting in turpentine, add a bit of common soap to make it stand the comb, and thin it with boiled oil.

To Imitate Pollard Oak.—The ground color is prepared with a mixture of chrome yellow, vermilion and white lead, to a rich light buff. The graining colors are Vandyke brown and small portions of raw and burnt sienna and lake ground in ale or beer. Fill a large tool with color, spread over the surface to be grained, and soften with the badger-hair brush. Take a moistened sponge between the thumb and finger, and dapple round and round in kind of knobs, then soften very lightly; then draw a softener from one set of knobs to the other while wet, to form a multiplicity of grains, and finish the knots with a hair pencil, in some places in thicker clusters than others. When dry put the top grain on in a variety of directions, and varnish with turps and gold-size; then glaze up with Vandyke and strong ale. To finish, varnish with copal.

To Imitate Mottled Mahogany.—The ground is prepared with the best English Venetian red, red lead, and a small portion of white lead. The graining colors are burnt sienna, ground in ale, with a small portion of Vandyke brown, sufficient to take away the fiery appearance of the sienna. Cover the surface to be grained, soften with the badger-hair brush, and while wet take a mottling-roller and go over the lights a second time, in order to give a variety of shade, then blend the whole of the work with the badger softener. Put the top grain on with the same color. When dry, varnish.

To Imitate Rosewood.—Mix vermilion and a small quantity of white lead for the ground. Take rose-pink, tinged with a little lampblack or Vandyke brown, and grind very fine in oil, then take a flat graining brush, with the hairs cut away at unequal distances, and cut down the grain as if wending round a

knot. When nearly dry, take a graining comb that is used for oak, and draw down the grain. This will give it the appearance of nature. When dry, varnish.

Another.—The ground color is prepared with vermilion and small quantities of white lead and crimson lake. When the ground is dry and made very smooth, take Vandyke brown, ground in oil, and with a small tool spread the color over the surface in different directions forming kind of knots. Before the work is dry, take a piece of leather, and with great freedom strike out the light veins; having previously prepared the darkest tint of Vandyke brown, or gum asphaltum, immediately take the flat graining brush with few hairs in it, draw the grain over the work and soften. When varnished, the imitation will be excellent.

Rosewood Imitation in Size.—Mix Venetian red, white-lead powder, vermilion and common size, the consistency of which, when cold, must be that of a weak trembling jelly. With this composition paint the work twice over. When the ground is dry take some lampblack, finely ground in beer, and beat the white of an egg into it; take the flat graining brush, dipped in the black, and put on the grain. When dry, stain the first coat of varnish with rose pink, finely ground in turpentine, and finish the work by giving it a coat of clear varnish.

To Imitate Bird's-Eye Maple.—The ground is a light buff, prepared with white lead, chrome yellow, and a little vermilion or English Venetian red, to take off the rawness of the yellow. The graining color is equal parts of raw umber and sienna ground in oil to the proper consistency. Spread the surface of the work with this color, and, having some of the same prepared a little thicker, immediately take a sash tool or sponge, and put on the dark shades, and soften with the badger-hair brush; before the color is dry put on the eyes by dabbing the dotting machine on the work. When dry, put on the grain with the camel-hair pencil on the prominent parts, to imitate the small hearts of the wood. When dry, varnish.

To Imitate Curled Maple.—Prepare a light yellow for

the ground, by mixing chrome yellow and white lead, tinged with Venetian red. The graining color is a mixture of equal portions of raw sienna and Vandyke, ground in ale; spread the surface to be grained in an even manner; then with a piece of cork rub across the work to and fro, to form the grains which run across the wood. When dry, varnish.

Curled Maple in Oil for Outside Work.—Prepare a rich ground by mixing chrome yellow, white lead and burnt sienna. For the graining color, grind equal parts of raw sienna and umber with a little burnt copperas in turpentine, and mix with a small quantity of grainer's cream. Thin the color with boiled oil; then fill a tool and spread the surface even, and rub out the lights with the sharp edge of a piece of buff leather, which must now and then be wiped to keep it clean; soften the edges of the work very lightly, and when dry, put on the top grain with burnt umber and raw sienna, ground in beer, with the white of an egg beat into it. When dry, varnish.

Satinwood.—This ground is prepared with white lead, stone ochre, and small quantities of chrome yellow and burnt sienna. The graining color is one-third of raw sienna and whiting, ground in pale ale, very thin; then spread the color over the surface to be grained. While wet, soften, and have ready a wet roller or mottling brush, in order to take out the lights; blend the whole with the badger-hair brush. When the work is dry, take the flat brush, and with the same color, put on the top again. When dry, varnish.

To Imitate Yew Tree.—The ground is a reddish buff. For the graining color grind in beer equal portions of Vandyke brown and burnt sienna, with a small quantity of raw sienna. When the ground is dry, spread the surface even with the color, and soften; then with a piece of cork with a sharp edge, rub the work cross and cross in order to form the fine grain. When dry, dip the tip of your fingers in the graining color to form the eyes or knots, and put in the small touches with a camel-hair pencil. When dry, put on the top grain, and when this is dry, varnish.

To Imitate Black and Gold Marble.—This description of marble is now in great demand. The ground is a deep jet black, or a dead color, in gold-size, drop black and turps; second coat, black japan. Commence veining; mix white and yellow ochre with a small quantity of vermilion to give a gold tinge; dip the pencil in this color, and dab on the ground with great freedom some large patches, from which small threads must be drawn in various directions. In the deepest parts of the black a white vein is sometimes seen running with a great number of small veins attached to it; but care must be taken that these threads are connected with, and run in some degree in the same direction with the thicker veins. If durability is not an object, and the work is required in a short time, it may be executed very quick in distemper colors, and when varnished it will look well.

Red Marble.—For the ground, put on a white tinged with lake or vermilion; then apply deep rich reds in patches, filling up the intermediate spaces with brown and white mixed in oil; then blend them together; if in quick drying colors, use about half turps and gold size. When dry, varnish; and while the varnish is wet, put in a multitude of the fine white threads, crossing the whole work in all directions, as the wet varnish brings the pencil to a fine point.

Jasper Marble.—Put on a white ground lightly tinged with blue; then put on patches of rich reds or rose pink, leaving spaces of the white grounds; then partly cover those spaces with various browns to form fossils, in places running veins; then put in a few spots of white in the centre of some of the red patches, and leaving in places masses nearly all white. When dry, use the clearest varnish.

Blue and Gold Marble.—For the ground put on a light blue; then lake blue, with a small piece of white lead and some dark common blue, and dab on the ground on patches, leaving portions of the ground to shine between; then blend the edges together with duster or softener; afterwards draw on some white veins in every direction, leaving large open spaces to be filled

up with a pale yellow or gold-paint; finish with some fine white running threads, and a coat of varnish at last.

To Imitate Granite.—For the ground color, stain your white lead to a light lead-color, with lampblack and a little rose-pink. Throw on black spots, with a graniting machine, a pale red, and fill up with white before the ground is dry.

Another.—A black ground when half dry, throw in vermilion, a deep yellow and white spots.

To Imitate Hair Wood.—For the ground color, take white lead and thin it with turpentine, and slightly stain it with equal quantities of Prussian blue and lampblack. For the graining color, grind in beer a mixture of Prussian blue and raw sienna; when the ground is dry, spread a transparent coat of the graining color on the surface of the work, and soften; then with the cork mottle by rubbing it to and fro across the work, to form the fine long grain or mottle. When this is done, soften and top grain in wavy but perpendicular directions; varnish when dry.

Graining Grounds.—The best and cheapest and most convenient simple material, for making grounds for light oak, maple, ash, and chestnut, is pure raw Italian sienna, tinted with pure white lead, not the so-called sienna which is sold by most paint dealers under that name, but the genuine article, which can be, and should be obtained even at some cost and trouble, the said article being one of the most useful and indispensable articles in the paint shop. For maple ground, of course the smallest quantity is required, it being necessary only to change the white to the faintest suggestion of straw color. For ash, the ground should be a little darker. For light oak, more of the sienna will be required, while for chestnut a decidedly yellowish tone is wanted. Care must be taken not to make the grounds too dark. Rather in the other extreme, for the reason that there is a remedy for a too light ground, in the application of a greater quantity of graining color, as also in the glazing coat; while a ground too dark cannot be made lighter. For dark oak, burnt Italian sienna with white will produce a far better ground than any other *single* color. The same

caution must be observed, however, in obtaining this color as recommended in the case of the raw Italian sienna. The domestic so-called siennas will not prove substitutes for the genuine Italian pigments. The ground for black walnut may be the same as for light oak with the addition of a little burnt sienna and black.

Mixing Colors.—The primary colors are those that cannot be compounded from other colors, being pure in themselves; they are three in number—red, blue and yellow; and from these three all others are compounded. From each of the three primaries in combination with either of the others, is derived certain groups of colors, termed secondaries and tertiaries, with the variations of tints and shades. All of these are regularly classified, and their combinations may be learned according to rule, with great pleasure to the learner, and an almost limitless addition to his resources. A standard authority on these subjects is "Chevreul on Color," which may be obtained at any book store. The combinations named below will enable the painter to mix many colors that he may require.

Cream Color.—Chrome yellow, the best Venetian red, and white lead.

Pearl-Grey.—White lead with equal portions of Prussian blue and lampblack. The blue must be used very cautiously, as it is a powerful color.

Fawn Color.—Burnt sienna, ground very fine, mixed with white lead.

Fawn Color.—White lead, stone ochre, and vermilion.

Buff.—This is a mixture of pale chrome yellow and white lead, tinged with a little Venetian red.

Straw.—A mixture of pale chrome yellow and white lead.

Drab.—Raw or burnt umber and white lead, with a little Venetian red.

Drab.—White lead with a little Prussian blue and yellow ochre.

Drab.—White lead with a little yellow ochre and lampblack.

Drab.—White lead with a little chrome green.

Purple.—White lead, Prussian blue, and vermilion.

Purple.—Prussian blue, vermilion, and rose madder or crimson lake.

Violet. Vermilion, French ultramarine, a small portion of black, and white lead.

French Grey.—White lead and Prussian blue, tinged with vermilion; and for the last coat, if cost is no object, substitute rose madder or lake for vermilion.

Silver.—White lead, indigo, and a small portion of black, as the shade may require.

Dark Chestnut.—Mix light red and black. Use red ochre when required to lighten the color.

Salmon.—White lead tinged with the best Venetian red.

Peach Blossom.—White lead tinged with orpiment.

Lead.—This is a mixture of vegetable black and white lead.

Dark Lead Color.—White, black, and indigo.

Chocolate.—Vegetable black and Venetian red.

Light Yellow.—Lemon yellow and white lead.

Light Yellow.—Chrome yellow, white lead, and red lead.

Light Yellow.—Raw sienna mixed with white lead. If the color is required of a warmer cast, add a little burnt sienna.

Stone Color.—Yellow ochre, burnt umber, and white lead.

Stone Color.—Raw sienna, burnt umber, and white lead.

Stone Color.—White lead, burnt umber, yellow ochre, and a little Venetian red.

Olive Green.—Prussian blue, chrome yellow, and burnt umber.

Olive Green.—Vegetable black, chrome yellow, and a small portion of burnt umber.

Grass Green.—Several shades of grass green may be made by mixing Prussian blue and chrome yellow.

Carnation.—Lake and white lead.

Imitation of Old Gold.—Mix white lead, chrome yellow, and burnt sienna, until the proper shade is obtained.

Colors for Outlines of Ornaments.—In decorative designs into which different colors enter, attention to the following

rules will greatly increase the beauty of the work; the rules are based on scientific principles.

First: Any color on a gold back-ground should be outlined with a darker shade of its own color.

Second: A gold ornament on a colored back-ground may always be outlined with black, provided the back-ground is not too dark; in that case outline with a light color.

Third: A colored ornament on a ground of complementary color should be outlined with a lighter tint of its own color, or a neutral color.

Fourth: If the ornament and ground are in shades of the same color, and the ornament is darker than the ground, the outline should be still darker; if the ornament is lighter than the ground, no outline is required.

Tones.—Often called shades, signify colors mixed with either white or black.

Tints are colors mixed with white.

Shades are colors mixed with black.

Tempera is a mixture of powdered colors with gum-water.

Distemper is a mixture of powdered colors with size.

Color Harmony in Grained Work.—It is unquestionably essential that every painter should know what plain colors and tints may be used in harmonious contrasts or combinations with the various painted imitations of fancy woods. Green is entirely unobjectionable; indeed, it forms a pleasing contrast with light oak, satinwood, bird's-eye maple, chestnut and ash—but discords with mahogany, black walnut and rosewood. Blue is entirely harmonious with all these latter. Black harmonizes with all the woods, as does white; but white with the lighter colored ones is feeble and wanting. All the woods harmonize with each other except black walnut with mahogany and rosewood. Gold is good with all, but the contrast with the light colored ones is not so brilliant as with the dark-toned woods. The bright colors in these deaden the usually dull tones of the black walnut and detract from

it thereby; whereas the contrast with the latter-named wood, with the light colored ones, improves and brightens all the contrasting tints and shades. Light and dark oak are best shown by themselves in contrast with each other, being too coarse in the grain to exhibit with good effect in combination with maple and satin-wood. In color harmony, generally, white and black harmonize with all colors but green. Gold is good with every color, shade and tint, but especially rich with green, black, purple, carmine and blue.

Chinese White.—The following is recommended as the best way to prepare Chinese white:—Dissolve as much Roman alum in as small a quantity of hot water as is barely sufficient, and then mix it with two ounces and a half of honey. Set this mixture to evaporate to dryness in an earthen vessel, over a gentle fire. It will then appear like a spongy sort of coal, which being removed from the fire, must be pounded, and the powder placed in shallow crucibles or cupels, so that it may lie very thinly on them. Expose these to a strong red heat for an hour; after this, the powder must be pounded again, and being replaced in the cupels it must be exposed anew to a strong heat, and to a free current of air for an hour longer. Being then removed from the fire, it is reduced upon a porphyry slab to an exceedingly fine powder of an intense whiteness. It may be mixed with gum-water, in the same manner as other paints are usually treated, and it is not apt, like white lead, to turn to a dusty hue.

Mixing White Lead.—To mix the white lead it should be placed in a can or pot, and an admixture of oil and turpentine being at hand, a small quantity should be poured over the white lead, and the whole stirred about with a stiff palette-knife or a stopping-knife, till the dilutent has become thoroughly incorporated with the white lead.

The mixture may now be stained to the required tint. For this purpose the staining color should be ground in oil, and added cautiously to the diluted white lead, some colors staining much more powerfully than others. The staining color should never be added in a powdered or dry state.

Varnish Green, for Venetian Blinds, etc.—The work must first be painted once or twice with a light lead color; when hard, grind some dry white lead in spirits of turpentine; afterwards take about one-third in bulk in verdigris, or navy green, which has been ground stiff in oil; then mix them both together, and add a little common oak varnish, sufficient only to bind the color. When this has been applied it will become hard in about fifteen minutes. Add more varnish to give a good gloss. Then go over the work a second time, and, if required, a third time. Thus you will have a beautiful green with a high polish. It possesses a very drying quality, enabling the work to be completed in a few hours. The tint may be varied according to taste, by substituting different greens; and if a bright grass-green is required, add a little Dutch pink to the mixture. This color is best used warm, as it gives the varnish a uniform appearance.

VARNISHES.

Varnishes are solutions of the various resins, commonly called gums, in either oil, turpentine, or alcohol. The gums principally applied are amber, anime, copal, lac, sandarac, mastic, damar and common resin. The varnishes are all applied to the surfaces of the woods, metals, or other materials, while in the fluid state, and the solvent is afterwards evaporated, leaving a thin glossy coat of the different resins as a defence from the action of the atmosphere, or from slight friction.

Sometimes the resins are used separately; at other times two or more are combined according to the qualities required in the varnish.

The Gums and their Qualities.—Amber.—The durability of the varnishes is of course mainly dependent upon the comparative insolubility of the resins; their hardness, toughness, and permanence of color. In these respects amber excels all other resins used for varnishes; it resists the action of all ordinary solvents, and can only be dissolved for making varnish by fusion at a high temperature; it is hard and moderately

tough, and its color is but little influenced by the atmosphere; but, unless very carefully selected, it is too yellow for delicate works of light colors. Amber is, however, but little used in making varnishes, principally on account of its high price, but partly because the varnish dries slowly, and does not attain its full hardness for many weeks.

Anime is nearly as insoluble and hard as amber, and the best is of a very pale color; but it is not nearly so tough as amber. The varnishes made from anime dry quickly, but are very liable to crack, and the color becomes deeper by exposure to light and air. Anime is, however, extensively used in making oil varnishes, and most of those called copal varnishes contain a considerable proportion of anime, which is substituted principally on account of its quick drying qualities.

Copal is next in durability to amber; when very carefully selected it is almost colorless, and becomes rather lighter by exposure; it is more easily dissolved by heat than either amber or anime, and although softer than these resins, is too hard to be scratched by the nail. Copal is, therefore, a most excellent material for varnish, and numerous attempts have been made to employ it as the basis of a spirit varnish, but hitherto with only partial success. Pure alcohol has little effect on copal; with the addition of a small quantity of camphor, the greater portion of the copal is dissolved, but the camphor impairs the durability of the varnish. Copal may be perfectly dissolved by ether, but this spirit evaporates too rapidly to allow of the varnish being uniformly applied. The essential oils of spruce and lavender have been occasionally employed as solvents of copal, but not with sufficient success to warrant its general adoption in spirit varnishes.

Oil Varnishes.—Amber, anime, and copal are usually dissolved for making varnish by fusing the gum, and adding linseed-oil heated nearly to the boiling point. They are then amalgamated by stirring and boiling, and the varnish is reduced to the required degree of fluidity by the addition of oil of turpentine. They constitute the more important of what are called oil varnishes, are the

most durable of all, possess considerable brilliancy, and are sufficiently hard to bear polishing. They are therefore employed for works of the best quality, that are exposed to the weather or to much friction; as coaches, house decorations, and japanning.

Spirit Varnishes.—Lac and sandarac are more soluble than the above resins, and are generally dissolved in spirits of wine; but sometimes the pyroligneous spirit, commonly known as vegetable naptha, is employed as a cheaper substitute. These resins constitute the basis of what are called spirit varnishes, and are employed principally for delicate objects not exposed to the weather, such as cabinet and painted works.

Lac is much harder and more durable than sandarac, and is the basis of most lackers for hard wood and metal, and also of French polish. Of the three varieties, stick-lac, seed-lac, and shell-lac, the latter is the most free from color, and the most soluble; it is therefore almost exclusively used in making varnishes and lacquers; but the palest shell-lac contains a considerable quantity of coloring matter, that renders it inadmissible for varnishing works of a light color. In addition, shell-lac also contains a small quantity of wax, and other matters, that are only imperfectly soluble in spirits of wine, and therefore give a cloudy appearance to the varnish, but which is not of great importance in varnishing dark-colored works, and may be in great measure avoided by making the solution without heat, and allowing the more insoluble portions time to be precipitated.

Sandarac is softer and less brilliant than shell-lac, but is much lighter in color; it is therefore used for making a pale varnish for light-colored woods, and other works for which the dark color of shell-lac would be unsuited. When hardness is of greater importance than paleness, a portion of shell-lac is added; but when paleness and brilliancy are required, a small quantity of mastic is added. When the varnish is required to be polished, Venice turpentine is added to give sufficient thickness or body.

Mastic is softer than any of the resins previously mentioned, and is dissolved either in spirits of wine or oil of turpentine; the

latter is more generally used on account of its cheapness. With either of these solvents mastic makes a varnish of a very pale color, that is brilliant, works easily, and flows better on the surface to which it is applied than most other varnishes. It is also tolerably flexible, and may be easily removed by friction with the hand; it is therefore much used for varnishing paintings, and other delicate works.

Damar is easily dissolved in oil of turpentine, and when carefully selected is almost colorless; it makes a softer varnish than mastic. The two combined, however, form an almost colorless varnish, moderately hard and flexible, and well suited for maps and similar purposes.

Common Resin is generally dissolved either in turpentine or linseed oil with heat. Varnish made with resin is hard and brittle, but brilliant, and is principally employed to make cheap varnishes for common purposes in house-painting, toys, and cabinet work. It is also added to other varnishes in order to improve their brilliancy, but it should be added in small quantities only, as a large proportion of resin renders the varnishes brittle.

The Solvents.—Linseed-oil is extensively employed as a vehicle for the harder resins, to which it imparts softness and toughness, but causes the varnish to dry slowly; and unless the oil is of the purest and palest quality, well clarified, and carefully combined with the resin, without excess of heat, it materially darkens the color of the varnish when first made, and it is also liable to become darker by age after it is applied. Linseed-oil intended for the best varnishes is clarified by gradually heating it in a copper pot, so as to bring it nearly to the boiling point in about two hours; it is then skimmed and simmered for about three hours longer, when dried magnesia, in the proportion of about one-quarter of an ounce to every gallon of oil, is gradually introduced by stirring; the oil is then boiled for about another hour, and afterwards suffered to cool very gradually. It is then removed into leaden or tin cisterns, and allowed to stand for at least three months, during which the magnesia combines with the impurities of the oil and carries them to

the bottom, and the clarified oil is taken from the top of the cistern as it is required without disturbing the lower portion, and the settlings are reserved for black paint. A pale drying oil may also be made as above, by substituting for the magnesia white copperas and sugar of lead in the proportions of two ounces of each to every gallon of oil.

Linseed-oil when rendered drying, by boiling and the addition of litharge and red lead, is sometimes used alone as a cheap extempore varnish. In boiling linseed oil, it is heated gradually to bring it to the boiling point in about two hours; it is then skimmed, and well-dried litharge and red lead, in the proportion of about three ounces of each to every gallon of oil, are slowly sprinkled in, and the whole is boiled and gently stirred for about three hours, or until it ceases to throw up any scum, or emit much smoke. It is then frequently tested by dipping the end of a feather into it, and when the end of the feather is burned off, or curls up briskly, the oil is considered to be sufficiently boiled, and is allowed to cool very slowly, during which the principal portion of the driers settle to the bottom. The oil is afterwards deposited in leaden cisterns screened from the sun and air. When the oil is required to be as pale as possible, dried white lead, sugar of lead, and white copperas are employed instead of the litharge and red lead.

Oil of Turpentine is employed as a vehicle for most of the resins, the oil varnishes being generally thinned with hot oil of turpentine. Mastic, damar, and common resin are generally made into varnishes by dissolving them in oil of turpentine alone, either cold or with very moderate warmth. Varnishes made with turpentine only, dry quicker than those made with oil, and are paler colored, but not so tough and durable. Turpentine varnishes hold an intermediate position between oil and spirit varnishes, and are employed principally on account of their cheapness and flexibility. Turpentine varies considerably in quality, and is greatly improved by age; that intended for varnish should be of the best quality, clear and limpid, and be kept for many months, or even years, before it is used; and when employed alone, as for

mastic varnish, care should be taken that it is not passed through an oily measure, as is frequently the case in procuring small quantities.

Alcohol, or Spirits of Wine, is employed for dissolving sandarac and shell-lac, to make the white and brown hard spirit varnishes, and lacquer for hard wood or brass, and also French polish. The varnishes made with alcohol dry much quicker, harder, and more brilliant than those made with turpentine; but if the spirit contains more than a minute proportion of water, it will scarcely dissolve the resins, and when the varnish is applied, a very slight degree of moisture in the atmosphere will cause the resins to be precipitated from the solution, giving the varnish a dull, cloudy, or milky appearance. It is therefore of the first importance, in making spirit varnishes, to procure the alcohol as pure as possible.

Ordinary spirits of wine, however, always contains a considerable proportion of water, and is commonly tested for varnish purposes by saturating a slip of writing-paper with the spirit, which is then ignited. If the flame of the spirit communicates to the paper, and the whole is burned, the spirit is considered to be sufficiently good; but if, as frequently happens, the paper should be so far saturated with the water remaining from the evaporation of the spirit as to prevent its burning, the spirit is rejected as unfit for varnish purposes.

Nearly pure alcohol may be obtained from ordinary spirits of wine, by adding about one-third its weight of well-dried carbonate of potash, agitating the bottle and then allowing it to stand for ten or twelve hours, during which time the potash will absorb much of the water from the spirit and fall to the bottom; the spirit may then be poured off, and fresh alkali added, and the process repeated until the potash remains quite dry; the alcohol is then to be freed from the small portion of potash which it holds in solution by distillation in a water-bath.

Naphtha, or the spirit procured by distillation from pyroligneous acid, and commonly known as vegetable or wood naphtha, is frequently employed instead of spirits of wine for making cheap

varnishes. It dissolves the resins more readily than ordinary spirit of wine, but the varnish is less brilliant, and the smell of the naphtha is very offensive. It is therefore never employed for the best works.

Preparation of Oil Varnishes.—The preparation of oil varnishes requires the application of considerable heat, and owing to this and the highly inflammable nature of the materials, the process is attended with considerable risk of setting the building on fire. The process, should, therefore, always be conducted in detached buildings constructed expressly for the purpose. Owing partly to the necessity for this precaution, and the circumstance that oil varnishes are greatly improved by being kept in leaden cisterns for some months before they are used, the preparation of oil varnish is carried on almost exclusively as a separate manufacture, the details of which are greatly varied, and are mostly kept secret.

The copper pot employed to make the varnish is called a *gum-pot*, and measures about two feet nine inches in height, and nine and a half inches diameter externally. The bottom is hammered out of a single piece of copper, and fashioned like a hat without a brim; it is about nine inches deep, and three-eighths of an inch in thickness. The upper part of the pot is formed as a cylinder, of sheet copper, about two feet two inches in height, and of sufficient diameter to slip about two inches over the upper edge of the bottom piece, to which it is firmly riveted. A wide flange of copper, to support the pot, is also fixed just beneath the lower edge of the cylinder, and a strong iron hoop is fixed a little above the line of the rivets, to serve for the attachment of the horizontal handle, which is made as a nearly straight rod, one inch square, flattened at the end, and two feet eight inches long.

The *stirrer* is a copper rod about three-quarters of an inch diameter, and three feet six inches long, flattened at the one end to one and a half inch in breadth for about eight inches in length, and fitted at the opposite end with a short wooden handle.

The ladle, which should contain about two quarts, is also of copper beaten out of the solid, and riveted to a handle of the same

metal, three feet six inches long, and fitted with a wooden handle like the stirrer.

The copper *jack*, for pouring hot oil into the gum-pot, is made in the form of a pitcher, with a large handle and a wide spout; it contains two gallons. The brass or copper sieve, for straining the varnish, is about nine inches diameter, and contains sixty meshes to the inch. The copper funnel, for straining the boiling varnish, is large enough to receive the sieve, and should be well made with lapped seams, as solder would be melted with the heat.

The tin pouring-pot, to hold three gallons, is formed exactly like a garden watering-pot, only smaller at the spout, and without any rose. This is never to be used for any purpose except pouring oil of turpentine into the varnish.

A small broom, termed a "swish," used for washing out the gum-pot every time after use, is made from cuttings of cane tied to a small handle like a hearth-broom; the head is five inches long, and five inches round. This should be washed in turpentine, and kept very clean.

A three-footed iron trevet, with a circular top, is employed to support the gum-pot. The feet of the trevet are about sixteen inches in height, and spread wider at the bottom than the top, which is made of such a size that the pot will fit easily into it, the flange resting on the top.

An ash-bed should be prepared near the fire, upon which to place the gum-pot when the varnish is ready for mixing, or the heat is becoming too great. This is prepared by sifting some dry ashes through a fine sieve, to make a smooth layer about one and a half inch thick, and a little larger than the bottom of the gum-pot.

Place the trevet in a hollow in a field, yard, garden, or out-house, where there can be no danger from fire; raise a temporary fireplace round the trevet with loose bricks, after the same manner that plumbers make their furnaces; then make up a good fire with either coke, coal, or wood charcoal, which is far preferable; let the fire burn to a good strong heat, set on the gum-pot with three pounds of gum copal; observe that if the fire surround the gum-

pot any higher inside than the gum, it is in great danger of taking fire. As soon as the gum begins to fuse and steam, put in the copper stirrer, and keep cutting, dividing, and stirring the gum to assist its fusion; and if it feels lumpy and not fluid, and rises to the middle of the pot, lift it from the fire and set it on the ash-bed, and keep stirring until it goes down. (in the mean time let the fire be kept briskly up); then set on the gum-pot again, and keep stirring until the gum appears fluid like oil, which is to be known by lifting up the stirrer so far as to see the blade. Observe, that if the gum does not appear quite fluid as oil, carry it to the ash-bed whenever it rises to the middle of the pot, and stir it down again (keep up a brisk fire), put on the pot and keep stirring until the gum rises above the blade of the stirrer; call out to the assistant "be ready!" He is then, with both hands, to lay hold of the copper-pouring jack, charged with (one gallon) clarified oil, and lean the spout about one inch and a half over the edge of the gum-pot. Let him keep himself firm, steady, and collected, and not flinch, spill, or pour the oil, which would perhaps set all on fire. Observe, when the gum rises within five inches of the pot-mouth, call out, "pour!" The assistant is then to pour in the oil very slowly until towards the last, the maker stirring during the pouring.

If the fire at this time is strong and regular, in about eight or ten minutes the gum and oil will concentrate and become quite clear; this is to be tested by taking a piece of broken window-glass in the left hand, and with the right lifting up the stirrer and dropping a portion of the varnish on it; if it appears clear and transparent, the oil and gum are become concentrated or joined together. It is now to be further boiled until it will string between the finger and thumb; this is known by once every minute dropping a portion on the glass and taking a little between the forefinger and thumb. If it is boiled enough it will stick strong and string out into fine filaments, like bird-lime; but when not boiled enough, it is soft, thick, and greasy without being stringy. The moment it is boiled enough, carry it from the fire to the ash-bed, where let it remain from fifteen to twenty minutes, or until it is cold enough to be mixed; have at hand a sufficient quantity of oil of turpentine to fill the pouring-

pot (two gallons); begin and pour out with a small stream, gradually increasing it, and if the varnish rises rapidly in the pot, keep stirring it constantly at the surface with the stirrer to break the bubbles, taking care not to let the stirrer touch the bottom of the pot, for if it should, the oil of turpentine would be in part converted into vapor, and the varnish would run over the pot in a moment; therefore, during the mixing, keep constantly stirring as well as pouring in at the same time. Have also a copper ladle at hand, and if it should so far rise as to be unmanageable, let the assistant take the ladle and cool it down with it, lifting up one ladleful after another, and letting it fall into the pot. As soon as the varnish is mixed, put the varnish sieve in the copper funnel placed in the carrying tin, and strain the varnish immediately; empty it into open-mouthed jars, tins, or cisterns, there let it remain and settle, and the longer it remains the better it will become. Recollect when it is taken out, not to disturb or raise up the bottoms.

Instead of the ash-bed, a circle of loose bricks four courses high may be erected to support the gum-pot. The bricks are to be laid so that when the gum-pot is set within, it will rest securely by its flange with the bottom about six inches from the ground. Upon this brick-stand set the pot every time there is occasion to carry it from the fire. Near the stand an iron trevet may be placed, upon which to turn the gum-pot every time after it is washed out, as, by so doing, it will always be kept clean, and cool gradually, for by cooling rapidly copper oxidizes very quickly. Near the trevet have the swish broom and also a large wide tin jack or other vessel to receive the washings. Have also at hand a copper ladle, and a tin bottle with turpentine, for washing with when wanted.

The moment the maker has emptied the gum-pot, throw into it half a gallon of turpentine, and with the swish immediately wash it from top to bottom, and instantly empty it into the tin jack. Afterwards, with a large piece of woollen rag dipped in pumice powder, wash and polish every part of the inside of the pot, performing the same operation on the ladle and stirrer; rinse them with the turpentine washings, and at last rinse them altogether

with clean turpentine, which also put to the washings, wipe dry, with a clean soft rag, the pot, ladle, stirrer, and funnel, and lay the sieve so as to be completely covered with turpentine, which will always keep it from gumming up.

Eight pounds of copal takes in general from sixteen to twenty minutes in fusing, from the beginning till it gets clear like oil; but the time depends very much on the heat of the fire and the attention of the operator. During the first twelve minutes while the gum is fusing the assistant must look to the oil, which is to be heated at a separate fire in a copper pot, large enough to contain double the quantity required. The oil should be brought to a smart simmer, for it ought neither to be too hot nor too cold, but in appearance beginning to boil, which the assistant is strictly to observe; and, when ready, call to the maker; then immediately each take hold of one handle of the boiling-pot and carry it to the ash-bed, the maker instantly returning to the gum-pot, while the assistant ladles the hot oil into the copper-pouring jack, bringing it and placing it at the back of the gum-pot until wanted.

A thick piece of old carpet, free from holes, should be kept at hand in case the gum-pot should take fire; should this happen, let the assistant throw the piece of carpet quickly over the blazing pot, holding it down all round the edges; and in a few minutes the fire will be smothered.

After the oil has been mixed with the gum, a brisk strong fire should be kept up, until a scum or froth rises and covers all the surface of the contents, when it will begin to rise rapidly. Observe when it rises about two-thirds the height of the pot, carry it from the fire, and set it on the ash-bed, or brick-stand, stir it down again; and if driers are to be added, scatter in a few by a little at a time; keep stirring, and if the frothy head goes down, put the pot on the fire, and introduce *gradually* the remainder of the driers, always carrying the pot to the ash-bed when the froth rises about two-thirds the height of the pot. In general, if the fire be good, all the time a pot requires to boil from the time of the oil being poured in, is about three and a half or four hours; but *time* is no criterion for a beginner to judge by, as it may vary according

to the weather, the quality of the ingredients, or the heat of the fire; therefore, about the third hour of boiling, try it on a bit of glass, and keep boiling it until it feels strong and stringy between the fingers, as before mentioned.

The foregoing directions are, with very little differences, to be observed in making all sorts of copal varnishes, excepting the quantities of oil, gum, etc., a few of which will be now added.

Copal Varnish for Fine Paintings, etc.—Fuse eight pounds of the very cleanest pale African gum copal, and, when completely run fluid, pour in two gallons of hot oil; let it boil until it will string very strong; and in about fifteen minutes, or while it is yet very hot, pour in three gallons of turpentine, got from the top of a cistern. Perhaps during the mixing a considerable quantity of the turpentine will escape, but the varnish will be so much the brighter, transparent, and fluid; and will work freer, dry quickly, and be very solid and durable when dry. After the varnish has been strained, if it is found too thick, before it is quite cold, heat as much turpentine and mix with it as will bring it to a proper consistence.

Artist's Virgin Copal.—From a select parcel of scraped African gum copal, before it is broken, pick out the very fine transparent pieces, which appear round and pale, like drops of crystal; break these very small; dry them in the sun, or by a very gentle fire. Afterwards, when cool, bruise or pound them into a coarse powder; then procure some broken bottles or flint-glass, and boil the same in soft water and soda; then bruise it into a coarse powder, like the gum; boil it a second time, and strain the water from it, washing it with three or four waters, that it may be perfectly clean and free from grease or any impurity; dry it before the fire, or upon a plate set in an oven. When thoroughly dry, mix 2 lbs. of the powdered glass with 3 lbs. of the powdered copal; after mixing them well, put them into the gum-pot, and fuse the gum; keep stirring all the time; the glass will prevent the gum from adhering together, so that a very moderate fire will cause the gum to fuse. When it appears sufficiently run, have ready three

quarts of clarified oil, very hot, to pour in. Afterwards, let it boil until it strings freely between the fingers. Begin and mix it rather hotter than if it were body varnish, for, as there is but a small quantity, it will be sooner cold; pour in 5 quarts of old turpentine, strain it immediately, and pour it into an open jar, or large glass bottle; expose it to the air and light, but keep it both from the sun and moisture until it is of a sufficient age for use. This is the finest copal varnish for fine paintings.

Cabinet Varnish.—Fuse seven pounds of very fine African gum-copal; when well dissolved, pour in half a gallon of pale clarified oil; and when clear mix with it three gallons of turpentine; afterwards strain it, and put it aside for use. This if properly boiled, will dry in ten minutes; but if too strongly boiled, will not mix at all with the turpentine; and *sometimes*, when boiled with the turpentine will mix, and yet refuse to amalgamate with any other varnish less boiled than itself; therefore, it requires a nicety which is only to be learned from practice. This varnish is very apt to chill all other oil varnishes to which it may be added, and is principally employed as a quick drying varnish for the occasional use of japanners, cabinet, and coach-painters. Cabinet varnish is, however, more generally made with anime than copal.

Best Body Copal Varnish for Polishing.—Fuse eight pounds of fine African gum-copal, add two gallons of clarified oil; boil it very slowly for four or five hours, until quite stringy, and mix it off with three and a half gallons of turpentine.

The above varnishes being made of the finest copal without driers are the palest and best of the copal varnishes, possessing great fluidity and pliability, but they are rather slow in drying and retain for months so much softness that they will not polish well, until they give out a moisture and become hard; after which they are very durable. When paleness is not of primary importance a second quality of gum is used, and when the varnish is required to dry quickly, sugar of lead or white copperas are introduced as driers, either singly or combined, in the proportion of from half a pound to one pound to each of the quantities above quoted, but

driers are always injurious to the color, brilliancy, and durability of varnishes. When a varnish is required that will dry quick and hard without driers, gum anime is substituted for the copal, but it is less durable and becomes darker by age. Frequently, anime varnish is mixed with copal varnish by the maker while both are hot, in different proportions according to the quality required; one pot of the anime to two of copal being used for a moderately quick drying body-varnish of good quality; and two pots of anime to one of copal for a quicker drying body-varnish of common quality.

Carriage Varnish is made much the same as common body-varnish, except that to eight pounds of gum of second quality about two and a half gallons of oil and five and a half gallons of turpentine are used with driers. This varnish is boiled until very stringy, and is used for the wheels and under framework of coaches and other objects not requiring to be polished; it is intermediate in quality between body varnish and the following.

Wainscot Varnish consists of eight pounds of second quality gum anime, three gallons of clarified oil, one-quarter pound of litharge, one-quarter pound of dried sugar of lead, one-quarter pound of copperas, well boiled until it strings very strong, mixed with five and a half gallons of turpentine. This varnish dries quickly, and is principally used for house-painting and japanning. When a darker varnish is required, as for mahogany, a small portion of gold-size may be mixed with it.

Pale Amber Varnish.—Fuse six pounds of fine-picked very pale transparent amber in the gum-pot, and pour in two gallons of hot clarified oil. Boil it until it strings very strong. Mix with four gallons of turpentine. This will be as fine as body copal, will work very free, and flow well upon any work it is applied to; it dries slowly, but becomes very hard, and is the most durable of all varnishes. It is very excellent to mix in copal varnishes, to give to them a hard and durable quality. Amber varnish is, however, but little used, on account of its expense.

In making all the above varnishes, it should be observed that

the more minutely the gum is fused, the greater the quantity and the stronger the produce. The more regular and longer the boiling of the oil and gum together is continued, the more fluid or free the varnish will extend on whatever it is applied. When the mixture of oil and gum is too suddenly brought to string by too strong a heat, the varnish requires more than its just proportion of turpentine to thin it, whereby its oily and gummy quality is reduced, which renders it less durable; neither will it flow so well in laying on. The greater proportion of oil there is used in varnishes, the less they are liable to crack, because the tougher and softer they are. Increase the proportion of gum in varnishes, the thicker the stratum required, and the firmer they will set, and the quicker they will dry.

All body varnishes, or those intended to be polished, should have one and a half pounds of gum to each gallon of varnish when it is strained off and cold. All carriage or wainscot varnishes or those not intended to be polished, should have full one pound of gum to each gallon. But the quantity of gum required to bring it to its proper consistence, depends very much upon the degree of boiling it has undergone; therefore, when the gum and oil have not been strongly boiled, the varnish requires less turpentine to thin it, and when boiled stronger than usual, a larger proportion of turpentine is required; if the mixing of the varnish with the turpentine is commenced too soon, and the pot is not sufficiently cool, there may be considerable loss by evaporation.

Copal varnishes should be made at least three months before they are required for use, and the longer they are kept the better they become; but when it is necessary to use the varnishes before they are of sufficient age, they should be left thicker than usual.

Preparation of Spirit and Turpentine Varnishes.—In the preparation of spirit and turpentine varnishes, scarcely any apparatus is required; as, generally speaking, the process is almost limited to mixing the resins and solvent together, and agitating the whole until the resin is thoroughly dissolved. Heat is not generally necessary, and although frequently resorted to in order to facilitate the dissolution of the resins, in most in-

stances only a moderate degree of warmth is required; consequently the preparation of spirit and turpentine varnishes is far more manageable than that of oil varnishes, and entails much less risk of accident.

The resins should be thoroughly free from moisture, and are generally broken into small pieces, in order that they may be dissolved more quickly, and all impurities are carefully picked out; after which the finest and clearest pieces are generally selected and set aside for making small quantities of varnish of a superior quality. Sometimes, with the view of expediting the dissolution of the resins, they are finely powdered before they are added to the solvent; but, in this case, it is necessary that the agitation should be maintained from the time the resin is added until it is thoroughly dissolved, otherwise it is liable to agglutinate into into one mass, that is afterwards very difficult of solution.

In making turpentine varnishes without heat, in quantities of ten or twelve gallons, the resin and turpentine are generally introduced into a large can with a wide mouth, and agitated by stirring with a stout stick; a number of wooden pegs or nails are mostly driven into the stick, near the lower end, to increase its effect.

Spirit varnishes are generally made in smaller quantities; and, to prevent the evaporation of the spirit the mouth of the vessel is mostly closed and the vessel itself is agitated. In making quantities of four to eight gallons, the resin and solvent are sometimes introduced into a small cask capable of containing about double the quantity, and mounted to revolve on central bearings at the ends. The cask is made to revolve either with continuous motion by a winch-handle, or with an alternating motion by means of a cord passed around the barrel and terminating in a cross-handle, which the operator pulls to give motion to the barrel in the one direction, and the momentum of which suffices to coil up the cord ready for the following pull, which causes the barrel to revolve in the opposite direction, and so on continually.

Quantities of varnish not exceeding two or three gallons, are generally agitated in a tin can, rolled backwards and forwards upon a bench covered with an old carpet or a sack; but whatever

method is adopted for the agitation, it should be continued, without intermission, until the resin is sufficiently dissolved to prevent the risk of its becoming agglutinated; the time required for which depends upon the solubility of the resin and the strength of the spirit, but is commonly from three to four hours. The further agitation for the thorough solution of the resin may be either continuous or intermittent, according to convenience, but it should not be abandoned until the solution is perfect; and when it is judged to be complete, the varnish is poured into another vessel for examination; and if any of the resin is not perfectly dissolved, the whole is returned to the vessel for further agitation. When the resin is all dissolved, the varnish is allowed to stand for a few hours, that any impurities may settle to the bottom, and the clear varnish is lastly strained through muslin or lawn into bottles, and allowed to stand for a few days before use.

Very small quantities of varnish are generally made in glass bottles, large enough to contain about one-third more than the quantity introduced, and they are shaken up at frequent intervals; but although, from the small bulk of the resin, it cannot agglutinate into so insoluble a mass as when larger quantities are made, still, when the agitation is intermitted, several days are frequently required before the resins are entirely dissolved, as the solution depends more upon the amount of agitation than the length of time the resins are submitted to the action of the solvent.

Sometimes, with the view of preventing the agglutination and facilitating the dissolution of the resins, coarsely-pounded glass is introduced with the resin and solvent; in this case the glass should be thoroughly washed and dried, and afterwards sifted, to exclude all the smaller particles, which, from their lightness, would have little effect in preventing the aggregation of the resin, and would be more troublesome to separate from the varnish.

When heat is employed in making spirit varnishes, the lowest temperature should be used that will suffice to dissolve the resins, as otherwise there is risk of losing a considerable portion of the alcohol by evaporation, thereby reducing the strength of the spirit; the varnish is also liable to be made of a darker color by

excess of heat, and those containing shell-lac are less clear and hard when made with heat than when made quite cold, as the heated spirit dissolves the greater portion of the wax contained in the shell-lac, and which becomes disseminated throughout the mass; but when the solution is made without heat, the principal portion of the wax and other impurities remain undissolved at the bottom.

In making large quantities of spirit varnish with heat, a still and worm are sometimes employed, in order to prevent loss by evaporation; the still is heated by a steam or water-bath, and the resins and solvent are agitated by a stirring-rod passing through a stuffing-box in the head of the still. Quantities of two or three gallons are generally made in a tin can, which is dipped at frequent intervals into hot water, and agitated between every dip by rolling; but in this case it is necessary to loosen the cork every time it is immersed in the hot water, in order to allow the vapor of the spirit to escape; otherwise the cork would be driven out with great force, and some of the spirit might be thrown on the fire with great risk of serious accident. Glass bottles, although convenient from their transparency, should never be employed for making varnish with heat, as they are liable to break from the alternations of temperature. They are, however, often used for making small quantities, and in this case the safer practice is to heat the water only in a moderate degree, and to allow of the continuous escape of the vapor through a small notch cut lengthwise in the cork, and which may be closed by the thumb when the bottle is shaken. There is, however, always some little risk of accident in making spirit varnishes near an open fire, when much heat is employed; and a water or sand-bath, placed on the top of a stove, so as to be heated only in a moderate degree, will be generally found to afford sufficient warmth, and is, perhaps, the most safe and convenient arrangement for occasional purposes.

Shell-lac never requires more than a very moderate warmth to dissolve it, and the solution is frequently made in stone bottles, placed near a fire and shaken occasionally. When it is re-

quired to be very clear, as for metal lacquer, it should be passed through filtering-paper before it is bottled.

It need scarcely be observed, that all the utensils employed in making spirit varnishes should be perfectly clean and dry, as the least moisture or even a damp atmosphere is liable to deteriorate the quality of the varnish.

Best White Hard Spirit Varnish, to bear polishing, is made by adding two pounds of the best picked gum sandarac to one gallon of spirit of wine; they are then shaken up without intermission for about four hours, or until the gum is quite dissolved; eighteen ounces of Venice turpentine is then moderately warmed, in a water-bath, to make it fluid, and poured into the varnish to give it a body; the whole is then well agitated for about one hour, and afterwards strained and put into bottles, which should be kept well corked, to prevent the evaporation of the spirit; after standing about a week, the varnish is fit for use. This varnish may be made sufficiently pale to be used on white work, when the clearest and palest pieces of the gum are carefully selected. When the work does not require to be polished, the proportion of Venice turpentine may be reduced one-half.

White Hard Varnish is also made with three and a half pounds of gum sandarac to one gallon of spirit of wine, and when they are dissolved one pint of pale turpentine varnish is added, and the whole are well shaken until thoroughly mixed. Another white hard varnish is made with two pounds of gum sandarac, one pound of gum mastic, and one gallon of spirit of wine.

White Spirit Varnish, for violins, is made with two pounds of mastic to one gallon of spirit of wine, and one pint of turpentine varnish. This may be made either in the same manner as the white hard varnish, or the ingredients may all be mixed together in a tin can, placed in a warm situation near a fire, and shaken occasionally until dissolved.

Brown Hard Spirit Varnish is made in the same manner as white hard varnish, but shell-lac is generally used instead of sandarac. Thus a very excellent brown hard spirit var-

nish that will bear polishing is made with two pounds of shell-lac to one gallon of spirit of wine; and, after they are amalgamated, eighteen ounces of Venice turpentine are warmed and added, exactly as described for the best white hard varnish. Another very good brown hard spirit varnish consists of two pounds of shell-lac, one pound of sandarac, and two ounces of mastic dissolved in one gallon of spirit of wine. A lighter-colored varnish is made with two pounds of sandarac, one pound of shell lac, and one gallon of spirit. After the resins are dissolved, one pint of turpentine varnish is added, and the whole is well mixed by agitation.

Hard-wood Lacquer is made, like the brown hard varnish, with two pounds of shell-lac to one gallon of spirit of wine, but without turpentine. Another hard-wood lacquer is made with one pound of seed-lac and one pound of white resin, dissolved in one gallon of spirit of wine.

French Polish is made in a great variety of ways; but the simplest, and probably the best, consists of one and a half pound of shell-lac dissolved in one gallon of spirit of wine without heat. Copal, sandarac, mastic, and gum-Arabic, are frequently used in making French polish, partly with the view of making the polish of a lighter color, and partly to please the fancy of the polisher; the proportions of the different gums are varied almost infinitely, but with little advantage. A polish that is by some considered to be very good is made with twelve ounces of shell-lac, six ounces of gum-Arabic, and three ounces of copal to one gallon of spirit of wine. When a dark-colored polish is required, half a pound of benzoin is sometimes added to one pound of shell-lac dissolved in one gallon of spirit, or four ounces of guaiacum are added to one and a half pound of shell-lac; at other times the polish is colored to the required tint with dragon's blood.

The shell-lac alone makes the hardest and most durable polish, and it is a frequent practice to make the polish rather thicker in the first instance than it is required for use, as it may be readily thinned by the addition of spirit. But if it should be made too thin originally, it would require to be thickened by dissolving a

further portion of shell-lac. With the view of avoiding any risk of the polish being made too thin in the first instance, the proportion of shell lac is frequently made two pounds to the gallon of spirit. Other resins are sometimes added, with the view of making the polish tougher. Thus, sometimes, the polish is made with one and a half pound of shell-lac, four ounces of seed-lac, four ounces of sandarac, and two ounce of mastic to the gallon of spirit; at other times the proportions are two pounds of shell-lac and four ounces of seed-lac to the gallon of spirit.

Bleached Shellac.—When a lighter-colored lac varnish, or polish is required than can be made with the palest ordinary shell-lac, the bleached lac, sold under the name of white lac, may be employed with advantage. The varnish made with the white lac is at first almost colorless, but becomes darker by exposure to the light.

Various modes have been adopted for bleaching lac varnish. One process is as follows: Six ounces of shell-lac, coarsely pounded, are to be dissolved by gentle heat in a pint of spirit of wine; to this is to be added a bleaching liquor, made by dissolving purified carbonate of potash in water, and then impregnating it with chlorine gas till the silica precipitates, and the solution becomes slightly colored. Of the above bleaching liquor add one or two ounces to the spirituous solution of lac, and stir the whole well together; effervescence takes place, and, when this ceases, add more of the bleaching liquor, and thus proceed till the color of the mixture has become pale. A second bleaching liquid is now to be added, made by diluting muriatic acid with thrice its weight of water, and dropping into it pulverized red lead, till the last added portions do not become white. Of this acid bleaching liquor small quantities at a time are to be added to the half-bleached lac solution, allowing the effervescence, which takes place on each addition, to cease before a fresh portion is poured in. This is to be continued till the lac, now white, separates from the liquor. The supernatant fluid is now to be poured away, and the lac is to be well washed in repeated waters, and finally wrung as dry as possible in a cloth.

Another process: Dissolve five ounces of shell-lac in a quart of rectified spirit of wine; boil for a few minutes with ten ounces of well-burned and recently-heated animal charcoal, when a small quantity of the solution should be drawn off and filtered; if not colorless, a little more charcoal must be added. When all color is removed, press the liquor through silk, as linen absorbs more varnish, and afterwards filter it through fine blotting paper.

Dr. Hare's process, published in the *Franklin Journal*, is as follows: Dissolve, in an iron kettle, one part of pearlash in eight parts of water; add one part of shell or seed-lac, and heat the whole to ebullition. When the lac is dissolved cool the solution, and impregnate it with chlorine gas till the lac is all precipitated. The precipitate is white, but the color deepens by washing and consolidation; dissolved in alcohol, lac, bleached by the process above mentioned, yields a varnish which is as free from color as any copal varnish.

A nearly colorless varnish may also be made by dissolving the lac, as in Dr. Hare's process; bleaching it with a filtered solution of chloride of lime, and afterwards dissolving the lime from the precipitate, by the addition of muriatic acid. The precipitate is then to be well washed in several waters, dried, and dissolved in alcohol, which takes up the more soluble portion, forming a very pale but rather thin varnish, to which a small quantity of mastic may be added.

Attempts are frequently made to combine copal with all the spirit varnishes, in order to give them greater toughness and durability; and although copal cannot be entirely dissolved, even in pure alcohol, still a moderate portion will be taken up by strong spirit of wine when a temperature of about 120° is employed with frequent agitation of the varnish. In this manner a light-colored varnish may be made with three-quarters of a pound of shell-lac, three-quarters of a pound of copal to one gallon of spirit of wine containing about ninety-five per cent. of alcohol. The copal should be powdered quite fine, and may either be added to the shell-lac and spirit at the commencement, in which case the shell-lac should also be powdered, or the shell-lac may be first dissolved

and the powdered copal added; but, in either case, it is only the more soluble portion of the copal that is taken up, and the remainder settles to the bottom to a viscid mass, from which the varnish may be decanted and strained for use. Copal may be added in the same manner to the white hard varnishes, and it is sometimes recommended to fuse the copal and drop it into water before attempting to dissolve it in spirit, but the advantage of adding copal to spirit varnishes is very questionable.

Lacquer for Brass, like French polish, is made in a great variety of ways; and, as in French polish, the simplest and best pale lacquer for works that do not require to be colored, consists of shell-lac and spirit of wine only, in the proportions of about half a pound of the best pale shell-lac to one gallon of spirit. Lacquer is required to be as clear and bright as possible; it is, therefore, always made without heat by continuous agitation for five or six hours. The lacquer is then allowed to stand until the thicker portions are precipitated, when the clear lacquer is poured off, and if it should not be sufficiently clear, it is afterwards filtered through paper into a bottle, which should be kept closely corked and out of the influence of light, which would darken the color of the lacquer. This may, however, be easily prevented by pasting paper round the bottle.

Colored Lacquers.—Lacquers are frequently required to be colored, either of yellow or red tints. For yellow tints, turmeric, cape aloes, saffron, or gamboge are employed; and for red tints, annotto and dragon's-blood are used—the proportions being varied according to the color required. Thus, for a pale yellow, about one ounce of gamboge and two ounces of cape aloes are powdered and mixed with one pound of shell-lac. For a full yellow, half a pound of turmeric and two ounces of gamboge, and for a red lacquer, half a pound of dragon's-blood and one pound of annotto. The color is also modified by that of the lac employed, the best pale or orange shell-lac being used for light-colored lacquers, and dark-colored shell-lac or seed-lac is used for the darker tints. For pale lacquers, sandarac is sometimes used with the shell-lac. Thus

a pale gold-colored lacquer is made with eight ounces of shell-lac, two ounces of sandarac, eight ounces of turmeric, two ounces of annotto, and a quarter of an ounce of dragon's-blood to one gallon of spirit of wine.

The most convenient method, however, of coloring lacquers, is to make a saturated solution in spirit of wine of each of the coloring matters, and to add the solutions in different proportion to the pale lacquer according to the tint required; but the whole of the coloring matters are not generally used by the same makers, and solutions of turmeric, gamboge and dragon's-blood afford sufficient choice for ordinary purposes. The turmeric gives a greenish-yellow tint, and, with the addition of a little gamboge, is the coloring matter employed in making the so-called green lacquer used for bronzed works.

Another mode of making lacquer: Four ounces of shell-lac and a quarter of an ounce of gamboge are dissolved by agitation, without heat, in twenty-five ounces of pure pyro-acetic ether. The solution is allowed to stand until the gummy matters not taken up by the spirit subside; the clear liquor is then decanted, and when required for use is mixed with eight times its quantity of spirit of wine. In this case, the pyro-acetic ether is employed for dissolving the shell-lac in order to prevent any but the purely resinous portions being taken up, which is almost certain to occur with ordinary spirit of wine, owing to the presence of water; but if the lacquer were made entirely with pyro-acetic ether, the latter would evaporate too rapidly to allow time for it to be equally applied.

Mastic Varnish, for painting, and similar purposes, is sometimes made in small quantities with spirit of wine; but, more generally, oil of turpentine is employed as the solvent, the proportion being about three pounds of mastic to the gallon of turpentine. For the best varnish, the mastic is carefully picked and dissolved by agitation without heat, exactly as for the best white hard varnish; after the mastic varnish has been strained it is poured into a bottle, which is loosely corked and exposed to the sun and air for a few weeks; this causes a precipitation, from which the clear

varnish may be poured off for use; but the longer the varnish is kept the better it becomes.

Mastic varnish works very freely, but it is liable to chill, and the surface frequently remains tacky for some time after the varnish is applied. To prevent the latter evil, it is recommended, before dissolving the mastic, to bruise it slightly with a muller, and pick out all the pieces that are too soft to break readily, and which may be used for common varnish. To prevent the chilling, which arises from the presence of moisture, Mr. W. Neil recommends a quart of river sand to be boiled with two ounces of pearl-ash; the sand is afterwards to be washed three or four times with hot water, and strained each time. The sand is then to be dried in an oven, and when it is of a good heat, half a pint of the hot sand is to be poured into each gallon of varnish, and shaken well for five minutes; it is then allowed to settle, and carries down the moisture of the gum and turpentine.

In making common varnish, heat is generally employed to dissolve the mastic, and about one pint of turpentine varnish is added to every gallon of varnish.

Turpentine Varnish is made with four pounds of common resin dirsolved in one gallon of oil of turpentine. It requires no other preparation than sufficient warmth to dissolve the resin. Sometimes resin and turpentine are mixed together in a stone or tin bottle, which is placed near the fire, or in a sand-bath over a stove, and shaken occasionally; but varnish-makers generally mix the resin and turpentine in the gum-pot, and employ sufficient heat to fuse the resin. This is a more expeditious practice, but is attended with some danger of fire. When a very pale turpentine varnish is required, bleached resin is used, and care is taken not to employ more heat than is necessary in making the varnish. Turpentine varnish is principally used for in-door painted works and common painted furniture and toys. It is also frequently added to other varnishes to give them greater body, hardness, and brilliancy.

Crystal Varnish is a name frequently given to very pale varnishes employed for paper works—Such as maps, colored paints,

and drawings. A very good crystal varnish is made with two pounds of mastic and two pounds of damar, dissolved without heat in one gallon of turpentine. Another good but more expensive crystal varnish is made with equal quantities of Canada balsam and oil of turpentine. In making this varnish, it is only necessary to warm the Canada balsam until it is quite fluid, then add the turpentine and shake the mixture for a few minutes until the two are thoroughly incorporated. The varnish may then be placed in a moderately warm situation for a few hours, and will be ready for use on the following day. These crystal varnishes are both nearly colorless, flow freely, and are more flexible, so as to bear bending or rolling, and either of them may be employed to make a tracing paper of middling quality, by applying a thin coat of varnish on one or both sides of any thin transparent paper, such as good tissue or foreign post-paper.

Paper Varnish, for paper-hangings and similar purposes, is made with four pounds of damar to one gallon of turpentine. The damar dissolves very readily in the turpentine, either with moderate agitation or a very gentle heat. Sometimes white or bleached resin is used instead of the damar, or the two are combined.

Water Varnish.—All the varieties of lac may be dissolved in nearly boiling water by the addition of ammonia, borax, potash, or soda, but these alkalies all have the effect of rendering the color of the lac much darker. The solutions may, however, be employed as varnishes, which, when dried, will resist the application of water sufficiently well to bear washing, especially when the proportion of alkali employed is only just sufficient to cause the dissolution o the lac, and which is also desirable in order to keep the varnish as light-colored as possible. The least color is given with diluted water of ammonia, in the proportions of about sixteen ounces of ordinary water of ammonia to seven pints of water and two pounds of pale shell-lac, to which about four ounces of gum-Arabic may be added. Borax is, however, more generally used, and the proportions are then two pounds of shell-lac, six ounces of borax, and

four ounces of gum-Arabic to one gallon of water. When the varnish is required to be as light colored as possible, white lac is employed.

Sealing-Wax Varnish, for coating parts of electrical machines, and similar purposes, is made by dissolving two and a half pounds of good red sealing-wax and one and a half pound of shell-lac in one gallon of spirit of wine.

Black Varnish may be made with three pounds of black sealing-wax and one pound of shell-lac to the gallon of spirit, or fine lampblack may be mixed with brown hard varnish or lacquer, according to the thickness required in the varnish. The interior of telescope tubes are frequently blackened with a dull varnish of this kind, made by mixing lampblack with rather thick brass lacquer, as little of the lampblack being employed as will serve to deaden the bright color of the lacquer. Mathematical instruments are sometimes blackened with a similar thin varnish, and the surface is afterwards brightened with one or two coats of lacquer applied as usual. Ordinary lampblack, however, generally contains greasy impurities and moisture, which render it unfit for varnish purposes, and therefore the best kind should be employed, or the lampblack should be purified by ramming it hard into a close vessel, and afterwards subjecting it to a red heat. In the workshop, when small quantities of lampblack are required, it is frequently made for the occasion, by placing a piece of sheet metal over the flame of an oil lamp. A black varnish, sometimes used for metal works, is made by fusing three pounds of Egyptian asphaltum, and, when well dissolved, half a pound of shell-lac and one gallon of turpentine are added.

Varnish for Iron.—Take 2 lbs. pulverized gum asphaltum, ¼ lb. gum benzoin, 1 gallon spirits of turpentine. To make this varnish quickly, keep in a warm place and shake often till it is dissolved. Shade to suit with finely-ground ivory black. Apply with a brush. This varnish should be used on iron work exposed to the weather. It is also well adapted for inside work, such as iron furniture, where a handsome polish is desired.

Varnish for Cane and Basket-Work.—Lac, prepared after the following recipe is used to cover split and colored cane: 2½ galls. of good linseed-oil are heated in a sand-bath, as long as a drop of it, poured on a cold stove, does not run when the stone is inclined, and when touched with the finger it feels thready. Then is added first in small portions, one pound fat copal varnish, and the vessel wherein the copal varnish is heated must be large, because by the addition of the linseed oil, a great deal of frothing takes place. When cold, the required consistence is given to the varnish by mixing it with turpentine-oil. It soon dries, preserves a sufficient elasticity, and may be applied with or without addition of colors.

POLISH REVIVERS, ETC.

French Polish Reviver.—½ pint linseed-oil, 1 oz. spirits of camphor, 2 ozs. vinegar, ½ oz. butter of antimony, ¼ oz. of spirits of hartshorn.

Another.—1 lb. of naphtha, 4 oz. of shellac, ¼ oz oxalic acid. Let it stand till dissolved, and add 3 ozs. linseed-oil.

Furniture Reviver.—Pale linseed-oil, raw, 10 oz.; lac varnish and wood spirits, of each 5 ozs. Mix well before using.

Furniture Cream.—1. Cut in small pieces a quarter of a pound of yellow wax, and, after melting it, add an ounce of well powdered colophony, which is a black resin or turpentine boiled in water, and afterwards dried. The wax and colophony being both melted, pour in, by degrees, quite warm, two ounces of oil or spirit of turpentine. When the whole is thoroughly mixed, pour it into a tin or earthen pot, and keep it covered for use. The method of applying it to the furniture, which must be first well dusted and cleaned, is by spreading a little of this composition on a piece of woollen cloth, and well rubbing the wood with it, and in a few days the gloss will be as firm and fast as varnish.

2. ¼ lb. of beeswax melted in an earthenware pot; add gradually ½ pint turpentine, colored with ½ oz. alkanet root; add

½ pt. linseed oil; mix well. Should be kept in wide-mouthed bottles for use. Note—This cream should not be used on newly-polished furniture.

Furniture Paste.—If it is required to keep the wood its natural color, scrape a quarter of a pound of beeswax into half a pint of turpentine. Linseed oil will darken the wood.

Six ounces of pearlash in a quarter of a pound of white wax, and one quart of hot water; simmer for half an hour in a pipkin. When cool the wax will float on the top, which must be taken off, and with hot water worked into a paste.

Equal parts of beeswax, spirit of turpentine, and linseed oil. Melt well together.

Four ounces of beeswax, ten ounces of turpentine, alkanet root to color. Melt together and strain.

To Make Furniture Paste.—Scrape two ounces of beeswax into a pot or basin; then add as much spirits of turpentine as will moisten it through. At the same time, powder an eighth part of an ounce of resin, and add to it, when dissolved to the consistence of paste, as much Indian red as will bring it to a deep mahogany color. Stir it up, and it will be fit for use.

Several Receipts for Furniture Cream.—Yellow wax, 4 oz.; yellow soap, 2 oz.; water, 50 oz.; boil, with constant stirring, and add boiled oil and oil of turpentine, each 5 oz.

Soft water, 1 gallon; soap, 4 oz.; white wax, in shavings, 1 lb. Boil together, and add 2 oz. pearlash. To be diluted with water, laid on with a paint brush, and polished off with a hard brush or cloth.

Wax, 3 oz.; pearlash, 2 oz.; water 6 oz. Heat together, and add 4 oz. boiled oil and 5 oz. of spirits of turpentine.

Pearlash, 1 oz.; water, 8 oz.; beeswax (genuine) 6 oz.; mix with heat, and add sufficient water to reduce it to the consistency of cream; for use add more water, and spread it on the wood with a painter's brush, let it dry, and polish with a hard brush or cloth.

Beeswax, 3 oz; pearlash, 2 oz.; water, 6 oz.; mix with heat, and add boiled oil, 4 oz.; turpentine (oil) 5 oz.; mix.

White Furniture Cream.—With the following receipt the vinegar must be mixed with the linseed-oil by degrees, and the bottle well shaken up. The spirit of antimony must afterwards be added, and well mixed. Six ounces of raw linseed oil, three ozs. methylated spirit, three ozs. white wine vinegar, half an ounce of butter of antimony.

GLUE.

Glue.—Glue is prepared from waste pieces of skin, horns, hoofs, and other animal offal. These are steeped, washed, boiled, strained, melted, reboiled and cast into square cakes, which are then dried. The strongest kind of glue is made from the hides of oxen; that from the bones and sinews is weaker. The older the animal the stronger the glue. Good glue should be hard in the cake, of a strong, dark color, almost transparent, free from black or cloudy spots, and with little or no smell. The best sorts are transparent and of a clear amber color. Inferior kinds are sometimes contaminated with the lime used for removing the hair from the skins of which they are made. The best glue swells considerably (the more the better) when immersed in cold water, but does not dissolve, and returns to its former size when dry. Inferior glue made from bones, will, however, dissolve almost entirely in cold water.

To Prepare Glue.—To prepare glue for use it should be broken up into small pieces, and soaked in as much cold water as will cover it, for about twelve hours. It should then be melted in a double glue pot, covered to keep the glue from dirt. Care must be taken to keep the outer vessel full of water, so that the glue shall not burn, or be brought to a temperature higher than that of boiling water. The glue is allowed to simmer for two or three hours, then gradually melted, so much hot water being added as will make it liquid enough, just to run off a brush in a continuous stream, without breaking into drops. When the glue is done with, some boiling water should be added to make it very thin before it is put away. Freshly-made glue is stronger than that which has

been repeatedly melted. Too large a quantity should not therefore be made at a time. Glue may be freed from the foreign animal matter generally in it by softening it in cold water, washing it with the same several times, till it no longer gives out any color, then bruising it with the hand, and suspending it in a linen bag beneath the surface of a large quantity of water at 66° Fahr. By doing this the pure glue is retained in the bag, and the soluble impurities pass through. If the softened glue be heated to 122° without water, and filtered, some other impurities will be retained by the filter, and a colorless solution of glue be obtained.

The addition of a little bichromate of potash will render glue impervious to moisture after exposing to the light, and a small quantity of methylated spirits will greatly improve its keeping qualities.

Mixing Glue.—A minimum amount of glue should be used in good work, and it should be applied as hot as possible. The surfaces of the wood to be united should be clean, dry, and true; they should be brought together as tightly as possible, so that the superfluous glue is squeezed out. The cohesion of a piece of solid glue, or the force required to separate one square inch, is four thousand pounds. The strength of common glue for coarse work is increased by the addition of a little powdered chalk. The hotter the glue the greater its cohesion; therefore in all large and long joints the glue should be applied immediately after boiling. Glue loses much of its strength by frequent re-melting; that glue, therefore, which is newly made, is much preferable to that which has been re-boiled.

Glue Pot.—A glue pot recently perfected consists of a circular kerosene lamp, made of tin, resting upon a tin bottom 8½ inches in diameter. The lamp is fitted with a tin chimney in place of glass, and fitted with a small aperture, covered with mica, so as to see how to regulate the flame. The glue pot is made of copper, tinned on the inside and supported upon a rim setting up about six inches from the bottom of the lamp, the rim supported by three legs, soldered and riveted to the rim and bottom of lamp rest.

The pot in which the bottom is placed has a portion of the bottom arched, to give more heating surface, and connecting with the chamber under the pot is a flue, passing out and up alongside of the pot, which carries off any smoke from the lamp, and also acts as a draft to the flame. This pot is five inches in diameter, and about six inches high. The pot for the reception of the glue is set in the same as an ordinary glue pot, and will hold about a quart of glue. The whole can be carred to any place where you wish to use it, and still have the heat kept up. The cost of oil is but a few cents a week.

Another improvement is in the pot being of copper, tinned. It will not corrode and spoil the glue, as is the case with iron.

French cabinet-makers use a glue pot with an inside pan made of glazed earthenware and divided radially into three divisions, in one of which is kept strong glue, in another weaker, and in the third water only, with a brush or piece of sponge for cleaning off superfluous glue from the work.

A few holes bored near the top of the inner vessel of a glue pot by admitting steam from the outer vessel will prevent the glue from solidifying on the side. They need not be bored round the whole circumference of the pot, to allow of pouring out the glue if necessary.

To Prevent Glue Cracking.—Glue frequently cracks because of the dryness of the air in rooms warmed by stoves. The addition of chloride of calcium to glue will prevent this disagreeable property of cracking. Chloride of calcium is such a deliquescent salt that it attracts enough moisture to prevent the glue from cracking. Glue thus prepared will adhere to glass, metal, etc., and can be used for putting on labels without danger of their dropping off.

Strong Glue to Resist Moisture.—Dissolve gum-sandarac and mastic, of each a quarter of an ounce, in a quarter of a pint of spirits of wine, to which add a quarter of an ounce of clear turpentine; now take strong glue, or that in which isinglass has been dissolved; then, putting the gums into a double glue-pot,

add by degrees the glue, constantly stirring it over the fire till the whole is well incorporated; strain it through a cloth, and it is ready for use. You may now return it to the glue pot, and add half an ounce of very finely-powdered glass; use it quite hot. If you join two pieces of wood together with it, you may, when perfectly hard and dry, immerse it in water, and the joint will not separate.

Glue to Resist Moisture.—To two quarts of skimmed milk add half a pound of the best glue; melt them together, taking care they do not boil over, and you will have a very strong glue, which will resist damp or moisture.

Portable Glue.—Boil one pound of the best glue, strain it very clear; boil also four ounces of isinglass; put it into a double glue-pot, with half a pound of fine brown sugar, and boil it pretty thick; then pour it into plates or moulds. When cold you may cut and dry them for the pocket.

This glue is very useful to draughtsmen, architects, etc., as it immediately dilutes in warm water, and fastens the paper without the process of dampening; or, it may be used by softening it in the mouth, and applying it to the paper.

MISCELLANEOUS RECEIPTS.

To Raise Old Veneers.—First, wash the surface with boiling water, and, with a coarse cloth, remove dirt or grease; then place it before the fire, or heat it with a caul; oil its surface with common linseed-oil, place it again to the fire, and the heat will make the oil penetrate quite through the veneer, and soften the glue underneath; then, while hot, raise the edge gently with a chisel, and it will separate completely from the ground; be careful not to use too great force, or the work will be spoiled. Again, if it should get cold during the operation, apply more oil, and heat it again. Repeat this process till the veneer is entirely separated, then wash off the old glue and proceed to lay it again as a new veneer.

To Take Out Bruises in Furniture.—Wet the part with warm water; double a piece of brown paper five or six times, soak it, and lay it on the place; apply on that a hot flat-iron till the moisture is evaporated. If the bruise be not gone, repeat the process. After two or three applications, the dent or bruise will be raised level with the surface. If the bruise be small, merely soak it with warm water, and apply a red-hot poker very near the surface; keep it continually wet, and in a few minutes the bruise will disappear.

To Make Paste for Laying Cloth or Leather.—To a pint of the best wheaten flour add resin, very finely powdered, about two large spoonfuls; of alum, one spoonful, in powder; mix them all well together, put them into a pan, and add by degrees soft or rain water, carefully stirring it till it is of the consistence of thinnish cream; put it into a saucepan over a clear fire, keeping it constantly stirred, that it may not get lumpy. When it is of a stiff consistence, so that the spoon will stand upright in it, it is done enough. Be careful to stir it well from the bottom, for it will burn if not well attended to. Empty it out into a pan and cover it over till cold, to prevent a skin forming on the top, which would make it lumpy.

This paste is very superior for the purpose, and adhesive. To use it for cloth or baize, spread the paste evenly and smoothly on the top of the table, and lay the cloth on it, pressing and smoothing it with a flat piece of wood; let it remain till dry; then trim the edges close to the cross-banding. If you cut it close at first, it will, in drying, shrink and look bad where it meets the banding all round. If used for leather, the leather must be first previously damped, and then the paste spread over it; then lay it on the table, and rub it smooth and level with a linen cloth, and cut the edges close to the banding with a short knife. Some lay their table cover with glue instead of paste, and for cloth perhaps it is the best method; but for leather it is not proper, as glue is apt to run through. In using it for cloth, great care must be taken that the glue be not too thin, and that the cloth be well rubbed down with a thick piece of wood made hot at the fire, for the glue soon

chills. By this method, the edges may be cut off close to the border at once.

Cements for Stopping Flaws in Wood.—Put any quantity of fine sawdust of the same wood your work is made with into an earthen pan, and pour boiling water on it, stir it well, and let it remain for a week or ten days, occasionally stirring it; then boil it for some time, and it will be of the consistence of pulp or paste; put it into a coarse cloth, and squeeze all the moisture from it. Keep for use, and, when wanted, mix a sufficient quantity of thin glue to make it into a paste; rub it well into the cracks, or fill up the holes in your work with it. When quite hard and dry, clean your work off, and if carefully done, you will scarcely discern the imperfection.

Mahogany-Colored Cement.—Melt two ounces of beeswax and half an ounce of Indian red, and a small quantity of yellow ochre, to bring the cement to the desired color; keep it in a pipkin for use.

Cement for Turners.—Melt together beeswax, one ounce; resin, half an ounce; and pitch, half an ounce; stir in the mixture some very fine brickdust to give it a body. If too soft, add more resin; if too hard, more wax. When nearly cold, make it up into cakes or rolls, which keep for use.

This will be found very useful for fastening any piece of wood on the chuck, which is done by applying the roller of cement to the chuck and it will adhere with sufficient force.

Tracing Paper.—A good firm tissue paper washed with a mixture of six parts spirits of wine, one of resin, one of nut oil. Apply with a sponge.

Another.—Canada balsam and turpentine, equal parts, will make a varnish which, if applied to one side of a good thin paper, will answer well. If it is meant to take watercolor, a coat of ox gall must be laid on.

Another.—Dissolve a piece of white beeswax, about the size of a walnut, in half a pint of spirits of turpentine; then, having procured some very fine white, woven tissue-paper, lay it on a clean

board, and, with a soft brush dipped in this liquid, go over one side, and then turn it over, and apply it to the other; hang it up in a place free from dust, to dry. It will be ready for use in a few days. Some add a small quantity of resin, or use resin instead of wax.

Mounted Tracings.—Tightly strain across an old drawing-board, by means of tacks slightly driven, a piece of cotton of tolerably good quality, but do not damp it, except with paste, as hereafter mentioned. Work the last in well with a painter's brush that has not been used for any other purpose. It is advisable to soak the brush, before using, for a few hours in cold water, so as, by expansion of the handle and constriction of the cordage, to tighten the hairs, and prevent them coming out with the paste. Paste also the back of the tracing, and, obtaining the assistance of another person, hold it by the corners over the strained fabric, allowing it to sag well, and lower it gently until the middle of the tracing first come into contact with the calico, after which gently and simultaneously lay down each corner. The tracing may now be gently dabbed with a clean cloth, commencing at the middle, and working out the blisters to the edge. A needle may sometimes be used with advantage to puncture small holes and set free the air in some of the obstinate blisters; but do not trouble to remove them all, as the smaller ones will quite disappear in drying. Do not rub the tracing whilst wet without the intervention of a sheet of large thin lining paper, such as is used for lining walls. Allow the tracing to dry gradually on the board without fire heat, and do not remove it until thoroughly dry. Draw on the scale before mounting, so that it may, by contracting and expanding with the drawing, be always true. The tracing, when mounted, presents a better surface for coloring than before. The board should be cleaned before using.

Cracks in Drawing Boards.—The material generally used in stopping the above is a composition made of glue and chalk, worked up to the consistency of putty, and applied to the board in a soft state, allowed to dry, and smoothed off with sandpaper.

To Temper Tools.—The quality of the steel should be uniform throughout; indeed, it is always better to have them tempered rather too hard than soft, for use will reduce the temper. If at any time it is necessrry to perform the operation yourself, the best method is to melt a sufficient quantity of lead to immerse the cutting part of the tool in. Having previously brightened its surface, plunge it into the melted lead for a few minutes, till it gets sufficiently hot to melt a candle, with which rub its surface; then plunge it in again, and keep it there till the steel assumes a straw color; but be careful not to let it turn blue. When that is the case, take it out, rub it again with the tallow, and let it cool. If it should be too soft, wipe the grease off, repeat the process without the tallow; and, when it is sufficiently hot, plunge it into cold spring-water, or water and vinegar mixed. By a proper attention to these directions, and a little practice, every workman will have it in his power to give a proper temper to the tools he may use. If a saw is too hard, it may be tempered by the same means; but as it would be not only expensive, but in many cases impossible to do it at home, a plumber's shop is mostly at hand, where the process may be repeated when they are melting a pot of lead. But here observe that the temper necessary is different to other cutting tools; you must wait till the steel just begins to turn blue, which is a temper that will give it more elasticity, and, at the same time, sufficient hardness.

Hardening Tools.—A communication to the *English Mechanic* says: "Mercury is the best liquid for hardening steel cutting tools. The best steel, when forged into shape and hardened in mercury, will cut almost anything. I have seen articles made from ordinary steel which have been hardened and tempered to a deep straw color, turned with comparative ease with cutting tools from good tool steel, hardened in mercury."

To Cut Good Steel Scrapers.—Part of the blade of a broken saw makes the best scrapers; but, as it is hard, it is very difficult to cut it into the required form. The best and most expeditious way is to mark it out to the size wanted, and then to place the blade or steel plate in a vise whose chaps shut very close,

placing the mark even with the face of the vise, and the part to be cut to waste above the vise. Then with a cold-chisel, or a common steel-firmer that has its basil broken off, holding it close to the vise and rather inclined upwards, begin at one end of the steel plate, and with a sharp blow of the hammer it will cut it. Keep going on by degrees, and you will with ease cut it to the shape required; then grind the edges of your scraper level, and finish by rubbing it on your Turkey-stone.

To Remedy Splits in Circular Saws.—Three methods:

Drill a small hole in the saw at the bottom of the split.

Drill six holes about $\frac{1}{4}$ inch in diameter, along the line of the crack, taking care that one of them falls just inside it; countersink the five outer holes on both sides, and rivet nicely up with *hot* rivets slightly less in diameter than the holes.

Cut a series of dovetails across the split, and insert therein copper dove-tails, which must be riveted tight by hammering on each side. The edges of the holes must be filed to an acute angle from each side of the saw, half the thickness of it, and the copper dove-tail pieces must not be quite long enough to fill the hole, but must fit in width exactly, and of course must be well annealed, and considerably thicker than the saw. When riveted, file off level with saw.

Brazing Band-Saws.—Good brass, rich in copper, is generally used. Bring the two ends of the saw close together and fasten, then take a small pan of charcoal, and place it under the ends, and direct the flame of a blowpipe on it. As the ends will soon become red hot, sprinkle some powdered borax upon them, and add the solder with a piece of iron. The way to make the solder melt: cast in ingot and file away; collect the filings, and put into solution of sal ammoniac in water, and so keep until wanted.

Saw Sharpening.—To sharpen the saw, take a triangular file, three-square file it is called, the handle in the right hand, the point of the file between the thumb and forefinger of the left hand,

apply it to the front of the first tooth that leans away from the operator. Let the point of the file incline towards the point of the saw, give three or four or more rubs of the file, and the point of the tooth will be sharpened, and the front brought to a sharp edge, and as the file will have passed over the top of the next tooth it also will be filed down, and the point partly sharpened.

Now apply the file to the front of this tooth; it leans towards the operator, so the point of the file must incline towards the handle of the saw. Give, as before, three or four rubs, according to the state of the saw, and the point of this tooth will also be sharpened, and its front brought to a sharp cutting edge. Go on in this way alternately, always remembering that when the tooth leans away from the operator the point of the file must incline to the point of the saw, and when the tooth leans towards the operator, then it must incline towards the handle of the saw.

If the saw has been sharpened before, it will be advisable to first run the file along the top of the teeth, to bring them all to a level.

Oiling Tools.—An English authority says: When a set of bench-planes is French-polished, they certainly look very well on the bench for a short time, but the French-polish does not add to their durability or usefulness, and, I think, gives them anything but a workmanlike appearance. My plan is to knock the irons out, weigh them, and then drop them into the linseed-oil barrel, and let them stay there a week; I then take and weigh them again to ascertain how much oil they have absorbed. The oil goes right to the heart of the planes, and as it sets it makes them hard, and they may be depended upon for keeping their shape. Rubbing them over every dinner hour for a week or two will give them a beautiful surface, and they will not show scratches or dents as they would if they were French-polished.

To Mark Tools.—Coat over the tools with a thin layer of wax or hard tallow, by first warming the steel and rubbing on the wax; warm until it flows and let it cool. When hard, mark the name through the wax with a graver and apply some aquafortis (nitric acid); after a few moments wash off the acid thoroughly

with water, warm the metal enough to melt the wax, and wipe it off with a soft rag. The letters will be found etched into the steel.

Varnish for Tools.—Take 2 oz. tallow, 1 oz. resin; melt together and strain, while hot, to remove the specks which are in the resin. Apply a slight coat on the tools with a brush, and it will keep off the rust for any length of time.

Boiler Incrustation.—The following remedies have been used, with varying success, to prevent the incrustation of boilers.

1. Potatoes, in weight one-fiftieth part that of the water, prevents the adherence of scale.

2. 12 parts of salt, 2½ parts of caustic soda, ⅛ part of extract of bark, ½ part of potash.

3. Pieces of oak-wood suspended in the boiler and renewed monthly.

4. 2 ounces of muriate of ammonia in the boiler twice a week.

5. A coating, consisting of 3 parts of black-lead and 18 parts of tallow, applied hot to the inside of the boiler every few weeks.

6. 12½ lbs. of molasses, fed into an 8-horse boiler at intervals, prevented incrustation for six months.

7. Mahogany or oak saw-dust in small quantities. Use this with caution, as the tannic acid attracts iron.

8. Carbonate of soda.

Non-Conducting Covering for Steam Pipes.—Sawdust mixed with flour and water into a thick paste is a non-conducting covering for steam pipes, cylinders, etc. The flour should be made into a very thin paste, and then the sawdust is stirred in. The adhesion of this composition is very great when applied on clean surfaces of wrought or cast iron; but on copper pipes it is necessary to wash them first with a clay-wash, made with potter's clay, until it forms a thin coating, after which the sawdust and paste will adhere firmly. It is very simple to apply; a small trowel is all that is necessary. Lay on five successive coats one-fifth of an inch thick. Let the pipes or other objects to be covered be kept warm by the aid of a little steam, and let one coat be perfectly dry before applying a second. Should the pipes

be outside, exposed to the open air, give them three or four coats of coal tar to make them waterproof, but if inside a building it is not necessary. It is well to pass the sawdust through a riddle to cleanse it from the coarse fragments of wood which are always to be found amongst sawdust. Steam pipes so covered lose less heat than when covered by any other known or patented process sold for that purpose. It is much less expensive and much more efficient.

To Harden Wood Pulleys.—Soft maple is often used in the construction of friction pulleys. If it is boiled in olive-oil it will prove beneficial in a number of ways. It will harden the timber and render it less liable to split, but at the same time the gear will slip more after such treatment.

To Prevent Belts Slipping.—A piece of rubber belting fastened around the belt pulley of an engine will keep the belt from slipping.

Rasps.—A farrier's rasp is an excellent tool for preparing a rough piece of wood or ivory for the lathe. Where only a small quantity of the material is required to be removed it will be found to be more convenient than the axe or paring-knife. There is also a somewhat similar tool used by shoemakers which, for smaller jobs, will be found equally efficient.

Soft Files.—Small single-cut files or "floats" of various shapes not hardened, may be met with at some of the dealers in watchmaker's tools, which are useful in finishing small articles in hard wood, ivory, and also gold and silver; they are used sometimes by jewellers for finishing, on account of their leaving a smooth surface behind them instead of a rough one, as a cross-cut file does.

Amalgam Varnish.—Melt together equal parts of bismuth, tin and quicksilver; when melted and cooled make it into a varnish with white of egg. It is used for the varnishing of plaster-of-Paris figures and others of the like kind. Some people recom-

mend lead, but lead soon becomes tarnished, but tin and bismuth will keep bright.

Painting and Preserving Ironwork.—A good black paint for coarse ironwork may be made by mixing plumbago with hot coal-tar. Equal parts of asphaltum and resin dissolved in common turpentine make also a good, cheap covering for heavy ironwork. For machinery, dissolve 2 lbs. india-rubber, 4 lbs. resin, and 2 lbs. shell-lac, in 5 gallons of benzine. This may be used with any other paint as a vehicle. Wrought-iron bridges are painted with white-lead as follows: The ironwork is first made clean by scrubbing and brushing it with wire brushes; this done, all the cavities and fissures are filled up with a putty of litharge, linseed-oil, varnish, and white-lead; this filling being dry, brushing is repeated. Afterwards a paint is applied, consisting of 300 lbs. of white-lead, 10 gallons of crude linseed oil, 1 or 2 gallons of boiled linseed-oil, and 1¼ gallons turpentine. This paint is repeated when sufficiently dry, and finally evenly overspread with white sand. Galvanizing is employed also to prevent rusting. A galvanizing paint consists chiefly of zinc powder and oil varnish Rusting is further prevented by rubbing the red-hot iron with wax, tallow, pitch, or coal-tar. Rubbing with heavy petroleum is also well adapted for keeping ironwork clean.

Preparing Soft Solder.—The following directions for soldering without fire or lamp may prove useful: Bismuth, ¼ oz.; quicksilver, ¼ oz.; block tin filing, 1 oz.; spirits of salts, 1 oz. Mix the whole together. Another soft solder for tin, etc.: Take lead, 1 part; tin, 1 part; bismuth, 2 parts; this melts in boiling water.

To Clean Silver Filigree.—Make a thin paste with cold water and cream of tartar, spread over ornaments thickly, fold in flannel, leave a week, then wash off with water, and they will be as good as new.

Bronzing on Metal.—The article must be chemically cleaned up, brushing with a mixture of fine pumice in dilute sulphuric acid, rinsed in pure water and dried. The bronze liquor

must be applied quickly and evenly with a camel's-hair brush, having first heated the article, just so as it can be held without burning the fingers.

Polishing Metals.—A useful compound for polishing and cleaning metals is composed of 1 oz. carbonate of ammonia dissolved in 4 oz. water; with this is mixed 16 oz. Paris white. A moistened sponge is dipped in the powder, and rubbed lightly over the surface of the metal, after which the powder is dusted off, leaving a fine brilliant lustre.

Imitation Marble.—Mix 1 lb. finely-powdered lime into a thick paste with water, and add ½ lb. of colophony, or, what is better, Venice turpentine. Allow the mixture to stand for some time, and then work up with it suitable quantities of fine white chalk and various colored earths, adding a few drops of olive oil if necessary. A soft mass is thus obtained, which can be moulded, like plaster-of-Paris, to any desired form, or it can be rolled out on a warm metal plate, or passed under wooden rollers, into thin sheets, which can be glued to the surface to be decorated, like ordinary veneers, and left to harden. It hardens and takes a good surface. Any cavities that appear must be filled up with some of the composition mixed with oil of turpentine. The composition will keep fit for use for some time, if covered with a damp cloth while moist.

To Polish Marble.—It sometimes happens that the cabinet-maker has a table top of marble to remount, which is scratched, and requires re-polishing. The following is the process used by the mason, and will, therefore, be acceptable in a work like the present. With a piece of sandstone with a very fine grit, rub the slab backward and forward, using very fine sand and water, till the marble appears equally rough, and not in scratches; next use a finer stone and finer sand, till its surface appears equally gone over; then, with fine emery-powder and a piece of felt or old hat wrapped round a weight, rub till all the marks left by the former process are worked out, and it appears with a comparative gloss on its surface. Afterward finish the polish with putty-powder and fine, clean rags.

As soon as the face appears of a good gloss, do not put any more powder on the rags, but rub it well, and in a short time it will appear as if fresh from the mason's hands.

Another.—Make a thick paste with rotten-stone and olive oil, and vigorously rub the marble with it on a cloth.

To Polish Black Marble.—Wash it with warm soap and water, and when dry rub it well with furniture paste or French polish, and then rub it with an old silk handkerchief. After one or two trials it will become quite bright.

To Clean Marble.—Mix the strongest soap-lees with quicklime to the consistency of milk; let it lie on the stone, etc., for twenty-four hours; then clean it off, and wash with soap and water, and it will appear as new. The polish will require to be renewed by the process given above.

Another.—Mix with ¼ pint of soap-lees, ½ a gill of turpentine, sufficient pipe clay and bullock's gall to make the whole into a rather thick paste. Apply it to the marble with a soft brush, and after a day or two, when quite dry, rub it off with a soft rag. Apply this a second or third time till the marble is quite clean.

To Remove Stains on Marble.—Apply spirits of salt and carefully wash off.

To Clean Pictures.—Wash with a sponge or a soft leather and water, and dry by rubbing with a silk handkerchief. When the picture is very dirty, take it out of its frame, procure a clean towel, and making it quite wet, lay it on the face of the picture, sprinkling it from time to time with clear soft water; let it remain wet for two or three days; take the cloth off and renew it with a fresh one; after wiping the picture with a clean wet sponge, repeat the process till all the dirt is soaked out; then wash it well with a soft sponge, and let it get dry; rub it with some clear nut or linseed-oil. Spirits of wine and turpentine may be used to dissolve the hard old varnish, but they will attack the paint as well as the varnish if the further action of the spirits is not stopped at the proper time by using water freely.

Cleaning Varnished Pictures.—There are conditions where the above simple process will not accomplish what is required; where a thick coating of varnish has been applied to the picture, and it has been hung in a smoky room, and dust and dirt has been allowed to gather and remain; then it is that no high lights will be visible, the sky will be dirty, no distance visible, and perhaps the figures in the foreground very indistinct. Under these conditions the varnish must be either removed or the smoke and dirt must be brought out of the varnish. If it is thought desirable to try the latter, the following receipt will be found valuable for the purpose: 2 oz. wood naptha, 1 oz. spirits of salts, ¼ pint of linseed-oil.

Mix the above well together, and before using shake the bottle. It can be used as follows: Get some soft linen rag, and make up a soft pad, which place on the mouth of the bottle and shake up some of the mixture into the pad, when commence rubbing the picture with a circular motion, and when nearly dry again give the pad another dressing of mixture, and continue this mode of procedure for some time, when the picture will gradually come out in all its detail.

Cleaning Engravings.—Put the engraving on a smooth board, cover it thinly with common salt finely powdered. Squeeze lemon juice upon the salt so as to dissolve a considerable portion of it; elevate one end of the board so that it may form an angle of about 45 or 50 degrees. Pour on the engraving boiling water from a tea kettle until the salt and lemon juice be all washed off. The engraving then will be perfectly clean and free from stains. It must be dried on the board or some smooth surface gradually. If dried by the fire or the sun it will be tinged with a yellow color.

Cleaning Engravings.—Presuming these to be mounted, proceed in the following manner: Cut a stale loaf in half, with a perfectly clean knife; pare the crust away from the edges. Now place the engravings on a perfectly flat table, and rubbing the surface with the fresh-cut bread, in circular sweeps, lightly but firmly performed, will remove all superficial markings. Now soak the prints for a short time in a dilute solution of hydrochloric acid, say

1 part acid to 100 of water, and then remove them into a vessel containing a sufficient quantity of clear chloride lime water to cover them. Leave them there until bleached to the desired point. Now remove, rinse well by allowing to stand an hour in a pan in which a constant stream of water is allowed to flow, and finally dry off by spreading on clean cloths. Perhaps the sheets may require ironing between two sheets of clean paper.

To Smooth a Damaged Picture.—Paintings sometimes get convex and concave patches on their surface, owing to pressure on one side or the other, and these inequalities cause a great deal of trouble to bring out. The most successful way is to well wet both sides of the picture on the spot, and keep it under pressure till dry. With small pictures the quickest way would be to take them off the stretcher and lay them in a press, with a light pressure between soft sheets of paper.

Embossed Gilding for Illuminating.—Gilding of figures and letters on paper and for the embellishment of manuscripts, is performed with shell gold tempered with gum water; or the characters may be drawn with a milky solution of gum ammanacum made in water, and gold leaf applied upon them when almost dry; they may again be sufficiently moistened for receiving the gold by breathing on them. Letters raised from the surface, if paper or parchment in the manner of embossed work, such as are seen on ancient manuscripts, may be formed either by friction on a proper body with a solid piece of gold, or by leaf gold.

The former method is practiced by tempering pulverizers' crystal with strong gum water, and with this paste forming the letters; when they are dry, they are rubbed with a piece of solid gold as in polishing, and the letters will appear as if gilt with burnished gold. The letters are formed with an embossed figure, either of the separate letters or of whole words cut in steel, and each letter of these stamps when they are used, is oiled evenly with a feather. Then fill these concave letters with the above paste, and strike the stamps in a perpendicular direction on the paper or vellum laid on sheets of soft paper.

When the embossed letters are formed with leaf gold, the following or a similar composition must be used. Thicken beaten whites of eggs with as much vermilion as is necessary to give them the consistence of paste; use the stamps as before, and when the letters are dry moisten them by a small pencil with strong gum water, and when this is almost dry cover the letters with leaf gold, pressing it close to every part of them with cotton wool; when dry, burnish.

Gold for Illuminating.—Procure a book of leaf gold, take out the leaves gently and grind them in a mortar with a piece of honey about the size of a hazel-nut, until it is thoroughly intermixed with the gold, then add a little water and re-work it; put the whole into a vial and shake it well. Let it remain an hour or two, and the gold will deposit at the bottom of the vial.

Pour off the liquor, and add weak prepared gum in its stead; sufficient to make it flow freely from the pen or camel's-hair pencil. When required for use, shake it occasionally.

To Stain Horn in Imitation of Tortoise Shell.—Mix an equal quantity of quicklime and red lead with strong soap lees, lay it on the horn with a small brush, in imitation of the mottle of tortoise-shell; when dry, repeat it two or three times.

To Stain Ivory or Bone Red.—Boil shavings of scarlet cloth in water, and add by degrees pearlash till the color is extracted; a little roach alum, now added, will clear the color; then strain it through a linen cloth. Steep your ivory or bone in aquafortis (nitrous acid) diluted with twice its quantity of water, then take it out, and put it into your scarlet dye till the color is to your mind. Be careful not to let your aquafortis be too strong; neither let your ivory remain too long in it. Try it first with a slip of ivory, and if you observe the acid has just caused a trifling roughness on its surface, take it out immediately, and put it into the red liquid, which must be warm, but not too hot. A little practice, with these cautions, will enable you to succeed according to your wishes; cover the places you wish to remain unstained with white wax, and the stain will not penetrate in those places, but leave the ivory of its natural color.

To Stain Ivory or Bone Black.—Add to any quantity of nitrate of silver (lunar caustic) three times its bulk of water, and steep your ivory or bone in it; take it out again in about an hour, and expose it to the sunshine to dry, and it will be a perfect black.

To Stain Ivory or Bone Green.—Steep your work in a solution of verdigris, sal-ammoniac and weak aquafortis, in the proportion of two parts of the former to one of the latter, being careful to use the precautions mentioned for staining red, as above.

To Stain Ivory, etc., Blue.—Stain your materials green according to the previous process, and then dip them in a strong solution of pearlash and water.

To Stain Ivory, etc., Yellow.—Put your ivory in a strong solution of alum in water, and keep the whole some time nearly boiling; then take them out and immerse them in a hot mixture of turmeric and water, either with or without the addition of French berries; let them simmer for about half an hour, and your ivory will be of a beautiful yellow. Ivory or bone should dry very gradually, or it will split or crack.

To Soften Ivory.—Slice a quarter of a pound of mandrake, and put it into half a pint of the best vinegar, into which put your ivory; let the whole stand in a warm place for forty-eight hours, when you will be able to bend the ivory to your mind.

To Bleach Ivory.—Take a double handful of lime, and slake it by sprinkling it with water; then add three pints of water, and stir the whole together; let it settle ten minutes, and pour the water into a pan. Take the ivory, and steep it in the lime-water for twenty-four hours, after which boil it in a strong alum-water one hour, and dry it in the air.

Artificial Ivory.—Two parts of caoutchouc are dissolved in 36 parts of chloroform, and the solution is saturated with pure gaseous ammonia. The chloroform is then distilled off at a temperature of 85° C. (185° F.) The residue is mixed with calcium phosphate or zinc carbonate, pressed into moulds and dried.

When calcium phosphate is used, the product possesses to a considerable degree the nature and composition of ivory.

Cement for Joining Leather.—A cement which has been found useful for this purpose may be prepared by mixing ten parts of bisulphate of carbon, one of oil of turpentine, and so much gutta-percha as is necessary to produce a thick fluidity. The leather must be first freed from all grease, which can be done by simply laying it in a cloth and pressing this with a hot iron. The parts to be joined, after being brought into contact with the cement, require to be kept pressed together until they are quite dry.

Cement for Leather and Wood.—Equal parts of pitch and gutta-percha melted together. This compound is insoluble in water.

Cement for Joining China, etc.—Beat the whites of eggs well to a froth, let them settle, add soft grated or sliced cheese and quicklime; beat them well together, and apply a little to the broken edges. This cement will endure both fire and water.

Cement for China, etc.—Pound half an ounce of resin and four ounces of gum-mastic; put them into a pipkin on the fire to melt; stir them well. To this add about half an ounce of finely-powdered glass, and half an ounce of quicklime; stir the whole well together. When nearly cold, form it into sticks, on a stone, in the same manner as sticks of sealing-wax are formed. When it is desired to cement any article, heat the broken edges sufficiently to melt the cement, which rub thinly on both edges; bring them accurately together; press them close, and let them cool. If this be carefully done, the work will sooner break in any other part than where the cement has been applied.

Cement for Glass.—Steep one ounce of isinglass in half a pint of spirits of wine for twenty-four hours; then let it dissolve over a slow fire (always keeping it covered, or the spirit will evaporate); now well bruise six cloves of garlic in a mortar, put them in a linen cloth, and squeeze the juice into the isinglass; mix all well together, and keep it for use. It is excellent to join glass ornaments, etc.

Cements for Aquariums.—Take 1 gill of plaster-of-Paris, 1 gill of litharge, 1 gill of fine white sand, ½ gill of finely-powdered resin. Mix well, and bottle and cork it until wanted for use, then mix it with boiled oil and dryers until as thick as putty. Mix the cement only in small quantities as it dries quickly.

Mix boiled linseed oil, litharge, red and white lead together, using white lead in the largest proportion, spread on flannel, and place on the joints.

A solution of glue, 8 oz. to 1 oz. of Venice turpentine; boil together, agitating all the time, until the mixture becomes as complete as possible, the joints to be cemented to be kept together for forty-eight hours if required.

Take ½ a gill of gold size, 2 gills of red lead, 1½ gill of litharge, and sufficient silver-sand to make it into a thick paste for use. This mixture sets in about two days.

To Restore the Elasticity of Cane-Chair Bottoms.—Turn up the chair bottoms, and with a hot water and sponge wash the cane work well, so that it may be well soaked; should it be dirty you must add soap. Let it dry in the air, and you will find it as tight and firm as when new, provided the cane is not broken.

Moths in Carpets.—Moths will work in carpets in rooms that are kept warm in winter as well as in summer. A sure method of removing the pests is to pour strong alum-water on the floor to the distance of half a yard around the edges before laying the carpets. Then once or twice during the season sprinkle dry salt over the carpet before sweeping. Insects do not like salt, and sufficient adheres to the carpet to prevent them alighting upon it.

To Destroy Moths in Carpets.—Take a wet sheet or other cloth, lay it upon the carpet, and then rub a hot flat-iron over it, so as to convert the water into steam, which permeates the carpet beneath, and destroys the life of the grub.

To Clean Carpets.—The carpet being first well beaten and freed from dust, tack it down to the floor; then mix half a pint of bullock's-gall with two gallons of soft water; scrub it well with

soap and the gall-mixture; let it remain till quite dry, and it will be perfectly cleansed, and look like new, as the colors will be restored to their original brightness. The brush used must not be too hard, but rather long in the hair, or it will rub up the nap and damage the article.

To Make Parchment Transparent.—Soak a thin skin of parchment in a strong ley of wood ashes, often wringing it out till it becomes transparent; then strain it on a frame, and let dry.

This will be much improved if, after it is dry, you give it a coat, on both sides, of clear mastic varnish, diluted with spirits of turpentine.

Tinting on Parchment.—On a good skin you may get an even tint, as follows: After "inking in" the plan, cover (with a large color brush) rather more than the whole of it with a strong wash of alum dissolved in water, taking care that every portion is saturated by the solution, and when dry brush away the dry alum, and the parchment will then take color almost as easily as paper, and the ink will not be disturbed.

India Ink Running.—If it is for drawing plans you may prevent it running by adding a little sugar to the India ink.

Erasing Indian Ink.—The most effective mode of erasing Indian ink lines is by rubbing the part to be erased with sandpaper of the finest quality, which will not only effectually remove the ink, but will leave a clear, smooth surface, which will take the ink better than at first, and may be colored upon.

To Make Carbon Paper.—Carbon paper, for copying or duplicating, can be made in the following manner: Take sweet oil, mixed to the consistence of cream, with either of the following paints (to produce the color desired): Prussian blue, lampblack, Venetian red, or chrome green; they should be ground fine on the stone. Use rather thin but firm paper, put on with a sponge, and wipe off as dry as possible; then lay them between uncolored paper, and press by laying a weight or some other heavy flat sub-

stance upon them until the surplus oil is absorbed, when it is ready for use.

Removing Oil Stains from Tiles.—You can remove oil stains from tiles completely by mixing fuller's earth into a thick paste with water, and spreading it over the tiles, letting it remain twenty-four hours, and then wiping it off. If the mark, then, has not quite gone, put on another paste.

To Polish Floors.—Put some spermaceti into a saucepan on the fire, and mix it with enough turpentine to make it quite fluid; then with a piece of flannel put it very thinly on the floor. It must then be rubbed with a dry flannel and brushed in the same way that oak stairs are polished. This part of the process, rubbing and brushing takes a long time to do thoroughly.

Another.—Dissolve half a pound of potash in three pints of water, in a saucepan on the fire; when the water boils throw in one pound of beeswax cut up in small pieces; stir it well until the wax is quite melted. When the polish is cold, if it be too thick, add more water, then with a brush paint the boards evenly with it; and when it has dried rub them with a flannel tied at the end of a broom.

Black Wax.—Add one ounce of beeswax to half an ounce of Burgundy pitch; melt them together, and add one ounce and a half of ivory-black, ground very fine, and dried.

Green Wax.—Melt one ounce of beeswax, and add half an ounce of verditer; let the pipkin be large enough, as the wax will immediately boil up. Stir it well, and add the eighth part of an ounce of resin, when it will be sufficiently hard and fit for use.

To Polish Tortoise Shell or Horn.—Having scraped your work perfectly smooth and level, rub it with very fine sand-paper or Dutch rushes; repeat the rubbing with a bit of felt dipped in a very finely powdered charcoal with water, and lastly, with rotten-stone or putty-powder; and finish with a piece of soft wash-leather, damped with a little sweet oil.

To Clean Looking Glasses.—Sponge down the glass

with gum and water, equal parts, then dust down with whitening, and finish with a soft old silk handkerchief.

To Remove Ink Stains.—Ink stains may be removed from a mahogany table by putting a few drops of spirits of nitre into a teaspoonful of water, and touching the part stained with a feather dipped into the mixture; immediately the ink stain disappears, the place must be rubbed with a rag wet with cold water, or there will be a white mark, which will not easily be removed. Ink stains on silver or plated articles may be removed immediately and effectually without doing any injury to the things, by making a little chloride of lime into a paste with water and rubbing the stains until they disappear, and afterwards washing the article with soap and water. Ink stains may be removed from colored table covers by dissolving a teaspoonful of oxalic acid in a teacupful of hot water and rubbing the stained part well with the solution. Ink stains may be taken out of anything white by simply putting a little powdered salts of lemon on the stain, damping it, allowing it to remain about five minutes, and then washing it out with soap and water, when the stain will disappear. Ink may be removed from boards by applying some strong muriatic acid or spirits of salt with a piece of rag and afterwards well washing the place with water.

To Remove Stains From Wood.—To half a pint of soft water put an ounce of oxalic acid and half an ounce of butter of antimony; shake it well, and when dissolved it will be very useful in extracting stains, as well as ink from wood, if not of too long standing.

To Clean Velvet.—Velvet requires very careful manipulation, as it loses its fine appearance if wrung or pressed when it is wet. To remove dust:—Strew very fine dry sand upon the velvet, and brush in the direction of the lines until all the sand is removed. The brush must be clean. To remove dirt:—Dissolve ox-gall in nearly boiling clean water, and add some spirits of wine. Dip a soft brush into this solution and brush the dirt out of the velvet. It may require repeated brushing. After this, hang it evenly up to

dry. For finishing, apply a weak solution of gum by means of a sponge to the reverse side of the velvet.

To Remove Paint or Stain from Wood.—Dissolve potash in water, making a strong solution, with this wash the surface of the work, allowing it to soak a few minutes. If the paint cannot then be scraped off, give the wood another application, and repeat until the paint is removed. Afterward, wash the surface with clean water sufficiently to ensure the removal of all the potash.

To Remove Varnish from Wood.—A strong application of ordinary spirits of camphor will remove almost any kind of polish or varnish. Give the spirit time to evaporate before repolishing, or it will injure the new polish.

The solution of potash, mentioned above, will also remove varnish.

Tests for Gilding.—If a gilt surface be touched with a drop of chloride of gold or nitrate of silver solution, the former will produce a brown, the latter a grey spot if the coating be an alloy, but will have no effect upon pure gold. For gilt paper, moisten with a drop of chloride of sulphur, which will immediately produce a dark brown margin if the covering is not pure gold. Metallic spangles shaken in close flasks with chloride of sulphur, suffer no change if gold, otherwise they gradually darken; but if under slight pressure, as in hermetically sealed tubes, gold spangles disappear in a short time by conversion into chloride of gold.

Anti-Attrition.—This mixture is made of one part of plumbago or blacklead ground very fine, and four parts of hog's lard or grease, mixed well together. It prevents the effects of friction much better than oil or other grease, and is very useful for the turner, and will be found to make the lathe work much easier, as well as to be a great saving in oil, which with constant use grows stiff, and sensibly impedes the motion; while this preparation, once applied, will last a long time without requiring renewal.

To Remove Grease from Cloth. Drop on the spot some oil of tartar, or salt of wormwood, which has been left in a

damp place till it turns into a fluid; then immediately wash the place with lukewarm soft water, and then with cold water, and the spot will disappear.

This will be found very useful, as it frequently happens that the cloth of the card tables, and the inside flaps of secretaries, are spotted and greasy. By proceeding as above, every spot of grease will be completely taken out.

Putty.—Painters use various kinds of putty, using varnish, japan, oil, keg lead, dry lead, red lead, whiting, zinc white, umber, yellow ochre, etc., in the composition of the various kinds. In mixing up putty the painter should always be governed by the time he may have in which to complete his work. If the work he is doing must be completed in an unreasonably short time, the putty should be mixed with very little or no oil, although a putty mixed with japan alone will dry quicker, so as to bear sand-papering in the shortest possible time, but it is a mealy, poor kind of putty, and is apt to shrink, allowing dampness to penetrate it when rubbed with pumice-stone and water.

The best and toughest kind of putty is made of keg and dry white lead, with only a small portion of japan. In making this kind of putty, use about 4 pounds of keg lead to about a gill of japan, mixing them thoroughly together; then add dry white lead in small quantities, pounding it lightly at first, and when you have added sufficient dry lead to form a mass like dough, use the mallet or hammer very freely. If dry zinc white is used instead of dry lead, the putty will be much better. This putty should be allowed three or four days to dry. Another kind of this necessary compound is made by using keg lead and red lead. The latter is of itself a powerful dryer, consequently it does not require so much japan to dry the putty. It works very easy and adheres to the wood very tenaciously, and is not apt to swell or shrink.

How to Boil Linseed Oil.—First be sure that you have the pure linseed oil. There is much sold as such manufactured out of peanuts. The test is simple. Nut oil has a sharp, acid taste, smells just like sour peanuts, is darker and thicker than the other

oil, has a clinging tendency when rubbed on the finger, dries with a gloss even in priming coats, and is very much given to gumming up when sanded. Pure linseed oil has a bright amber color, runs freely, sparkles when flowing from the can, tastes smooth and mild, and has the smell of a flax-seed poultice. When you are satisfied that you have the genuine oil, and wish to boil it thoroughly, first take, say about one-half pound of red lead and the same quantity of sugar of lead, put into five gallons of the oil, and place over a slow fire so as to boil evenly. Do not let your fire get either too hot or too low; keep an even temperature, if possible; coke or charcoal is preferable to either hard or soft stone coal. Avoid a wood fire, as, after the oil gets to boiling heat, a sudden flame shooting up might ignite the entire lot. Let it boil seven hours full; the red lead and sugar of lead will then become dark brown. Stir all the time while boiling slowly, and only one way; do not change the direction of the stroke or you will burn the oil, just as you would starch. After you have taken it from the fire, cover it up and let it stand to cool off, say overnight. The sediment will settle; pour out the oil and strain; your oil is boiled, and a better article you could not have, as all the fatty substances are destroyed. This is the English method, used in all the carriage factories in the United Kingdom.

Mordants for Staining Wood.—Sulphuric acid, more or less diluted, according to the intensity of the color to be produced, is applied with a brush to the wood, previously cleaned and dried. A lighter or darker brown stain is obtained, according to the strength of the acid. When the acid has acted sufficiently its further action is arrested by the application of ammonia. Tincture of iodine yields a fine brown coloration, which, however, is not permanent unless the air is excluded by a thick coating of polish. Nitric acid gives a fine permanent yellow, which is converted into a dark brown by the subsequent application of tincture of iodine.

Ebonizing.—To French-polish a black sideboard it is not absolutely necessary to use black polish, but it is usual to do so,

as it produces a finer black. The sideboard, or any kind of furniture, is polished in the usual manner, by using black polish, and filling up the grain with black; the simplest kind is weak glue and lamp-black. When dry, paper down and polish as usual. The rubber of the polisher should be dipped in ivory-black, or gas-black, moistened with black polish, covered with linen rag, a touch of linseed oil, and used as usual. Black polish is made thus:— One gill dark French polish poured into a clean bottle, then add ½ oz. best ivory-black, or gas-black is best; in fine powder well, shake until mixed, and used as before described. Gas-black is made by impinging a broad gas burner on the bottom of a glue-pot or sheet of metal, and gathering the black as made.

Picture Frames.—A simple plan for holding frames in position till dry is to tack lengths of wood on a board, and after laying the frame between them, gently press wedges till the joints are home. It is such a common complaint of the nonconformity between the first and last mitre, that gilt corners are made ready, like charity, to cover a multitude of sins. These, if laid on a damp cloth, soon become sufficiently pliable to take the bend of the moulding, and, besides being very cheap, are a great improvement and a blessing to many besides amateurs.

Varnish for Tools.—For tool handles there is nothing better than shellac varnish. It should be put on before the handle is removed from the lathe. Use it the same as French polish, and in small quantities.

Painting on Zinc.—According to the *Painter's Magazine*, painting on zinc is made easier by employing a mordant composed of one quart of chloride of copper, one of nitrate of copper, and one of sal ammonia, dissolved in 64 parts of water, and to this mixture is added one part of commercial hydrochloric acid. This is brushed over the plate of zinc, and after 12 or 24 hours it drys a dullish gray color. Painting upon this surface the colors will adhere in a perfect manner. Another method, according to the same authority, is as follows: Procure some muriatic acid of full strength, and drop into it some pieces of zinc until effervescence

ceases. Add an equal quantity of water, and with a sponge tied to a stick wash over every part of the surface to be painted. This roughens the surface and takes off that sort of greasiness which prevents paint from adhering. After the acid has remained a short time wash it over with water or diluted vinegar, dry off and paint.

Violin Varnish.—The *Scientific American* gives the following formula for preparing a beautiful varnish for violins: Rectified alcohol, half gallon; add six ounces gum sandarac, three ounces gum mastic, and half a pint turpentine varnish; put the above in a tin can by the stove, frequently shaking until well dissolved. Strain and keep for use. If you find it harder than you wish, thin with more turpentine varnish.

Imitating Mahogany.—When curly-veined birch and beech have been regularly brushed with aquafortis and dried at the fire, they both look remarkably like mahogany. A decoction of logwood and fustic, when put on in a tepid state, produces a similar effect. The French mode consists in brushing the white timber with a dilute solution of nitrous acid; it is then coated once or twice with finishing spirit, in which a quantity of carbonate of soda and dragon's-blood has been dissolved, the proper proportions to 1 gill of spirit being ¾ of an ounce of the soda, and ¼ of an ounce of the blood; the wood is afterwards finished with varnish or polish of a reddish-brown tint. In producing this shade of color, London stainers frequently use a rich brownish-red kind of chalk, the color of which is analogous to that of fine Spanish mahogany. It is commonly applied in the form of a dry powder, by means of a brush, and then well rubbed with another brush or coarse flannel.

To Stain Beech a Mahogany Color.—Put 2 oz. of dragon's-blood, broken in pieces, into a quart of rectified spirits of wine; let the bottle stand in a warm place, shake it frequently; when dissolved it is fit for use.

Imitation of Mahogany.—Plane the surface smooth, and rub with a solution of nitrous acid. Then apply with a soft brush one ounce of dragon's-blood dissolved in about a pint of

alcohol, and with ⅓ of an ounce of carbonate of soda mixed and filtered. When the brilliancy of the polish diminishes, it may be restored by the use of a little cold-drawn linseed-oil.

Bronzing Inlaid Work.—A method used for decorating inlaid work is the use of a bronzing liquid, which consists of a fluid bronze composition formed by combining metallic powder of gilding and bronze powder with collodion, which composition is capable of being applied as a bronze liquid to surfaces of wood, iron, or any solid material, for the purpose of coating the same for decoration or preservation.

To Imitate King or Botany Bay Wood.—Boil ½ lb. French berries in 2 quarts of water till of a deep yellow, and while boiling hot give two or three coats; when nearly dry, form the grain with black stain, which must also be used hot. For variety, to heighten the color, after giving it two or three coats of yellow, give one of strong logwood liquor, and then use the black stain as directed.

Black Stain.—Boil 1 lb. of lowood in 4 quarts of water, add a double handful of walnut peels or shells; boil it up again, take out the chips, add a pint of the best vinegar, and it will be fit for use; apply it boiling. This will be improved, if, when dry, a solution of green copperas, an ounce to a quart of water, is applied hot over the first stain.

Black Stain for Immediate Use.—Boil ½ lb. of chip logwood in 2 quarts of water, add 1 oz. of pearlash, and apply it hot to the work with a brush. Then take ½ lb. of logwood, boil it as before in 2 quarts of water, and add ½ oz. of copperas; strain it off, put in ½ lb. of rusty steel filings; with this go over the work a second time.

Brown Stain.—Paint over the wood with a solution made by boiling 1 part catechu, cutch, or gambier, with 30 parts of water and a little soda. This is allowed to dry in the air, and then the wood is painted over with another solution made of 1 part of bichromate of potash and 30 parts of water. By

a little difference in the mode of treatment, and by varying the strength of the solutions, various shades of color may be given with these materials, which will be permanent, and tend to preserve the wood.

Red Stain.—1. Take 1 lb. of Brazil wood to 1 gallon of water, boil 3 hours with 1 oz. of pearlash, brush it hot on the wood, and while hot brush the wood with a solution made with 2 oz. of alum in 1 quart of water. 2. An infusion of Brazil wood in stale urine, in the proportion of a pound to a gallon for wood; to be laid on when boiling hot, and should be laid over with alum water before it dries. Or, a solution of dragon's-blood in spirits of wine may be used.

Red Stain for Bedsteads and Common Chairs. Archil will produce a very good stain of itself when used cold; but if, after one or two coats being applied and suffered to get almost dry, it is brushed over with a hot solution of pearlash in water, it will improve the color.

Walnut Stain.—Water, 1 quart; washing soda, 1½ oz.; Vandyke brown, 2½ oz.; bichromate of potash, ¼ oz. Boil for 10 minutes, and apply with a brush, in either hot or cold state.

INDEX.

Anti-attrition, 122.
Belts, to prevent slipping, 108.
Black stain, 127.
Boiler incrustation, 108.
Bronzing, 54.
    inlaid work, 127.
    on metal, 110.
Brown stain, 127.
Bruises in furniture, to take out, 102.
Brushes for varnishing, 29.
Cane-chair bottoms, to restore elasticity, 118.
Carbon-paper, to make, 118.
Carpets, to clean, 118.
    to destroy moths in, 118.
Carving, reeding etc., 18.
Cements for aquariums, 118.
    for china, 117.
    for glass, 117.
    for joining leather, 117.
    for leather and wood, 117
    for stopping flaws, 103.
    for turners, 103.
Circular saws, to remedy splits in, 106.
Color harmony in grained work, 67.
Colored woods, metals, etc., 11.
Colors for outlines of ornaments, 66.
Colors, to mix, 66.
    buff, 66.
    carnation, 66.
    chestnut, dark, 66.
    Chinese white, 65.
    chocolate, 66.
    cream, 65.
    drab, 65.
    fawn, 65.
    French grey, 66.
    gold, imitation of, 66.
    green, grass, 66.
    green, olive, 66.
    lead, 66.
    peach blossom, 66.
    pearl, 65.
    purple, 66.
    salmon, 66.
    silver, 66.
    stone, 66.
    straw, 65.
    varnish green, 69.
    violet, 66.
    white lead, 68.
    yellow, 66.
Composition for frame ornaments, 49.
Cracks in drawing-boards, 104.
Dye, black, fine, 44.
    blue, fine, 44.
    gray, 46.
    green, 45.
    liquid, for brightening and setting, 46.
    orange, 46.
    purple, 46.
    red, 45.
    yellow, fine, 45.
Dyeing wood, 43.
Ebonizing, 124.
Ebony finish, 33.
Engravings, to clean, 113.
Files, soft, 109
Filigree, silver, to clean, 110.
Fillers, 23.
    cherry, 25.
    light-wood, 24.
    oak, 25.
    rosewood, 25.
    sizing, 25.
    walnut, 24.
Finishing, 20.
    processes of, 22
    varieties of, 31.
        dead-finish, 32.
        ebony finish, 33.
        French polishing, 34.
        varnish finish, 33.
        wax finish, 33.
        wax finish, imitation, 33.
        flowing, 30.
Floors, to polish, 120.
Framing work, 11
French polish, 34, 36.
French polishing, 31.
Furniture cream, 96.
Furniture paste, 97
General remarks on designs for cabinet work, 9.
Gilding, 47.
Gilding, burnish, 51
    applying the size, 52.
    burnishing, 53.
    finishing, 53.
    laying the gold, 52.
    matting or dead gold, 53.
    polishing, 52.
    preparing the woodwork, 51.
    gilders' cushion, 48.
    oil, 50.
    sizes for, 48.
    to manipulate gold leaf, 54.
    oil size for, 49.
    parchment size for, 49.
    gold size for burnish, 49.
    the requisites, 48.
    to prevent gold adhering, 49.
Gilding, embossed, for illuminating, 114.
    silvering and bronzing, 47.
    tests for, 96.
Glue, 98.
    portable, 101.
    mixing, 99
    to prepare, 98.
    to prevent cracking, 100.
    to resist moisture, 100.
Glue pot, 99.
Graining, 55.
    grounds, 58.
        bird's-eye maple, 59.
        mixing colors, 58.
        mahogany, 58.
        oak, 59.
        rosewood, 58.
        the process, 56.
Grease, to remove from cloth, 97.
Gums and their qualities, 69.
    amber, 69.
    anime, 70.
    bleached shellac, 81.
    copal, 70.
    damar, 72.
    lac, 71.

Gums, mastic, 71.
resin, 72.
sandarac, 71.
Horn, to polish, 120.
to stain in imitation of tortoise shell, 115.
How to boil linseed-oil, 123.
Imitation mahogany, 126.
India ink, to erase, 119.
to prevent running, 119
Ingredients, 35.
Ink stains, to remove, 119.
Inlaying, 15.
with shaded wood, 16.
Ironwork, painting and preserving, 110
Ivory, artificial, 116.
to bleach, 116.
to soften, 116.
or bone, to stain black, 116.
blue, 116.
red, 115.
yellow, 116.
Lac, gum, 71.
Lacquers, colored, 91.
for brass, 91.
hardwood, 88.
Looking glasses, to clean, 120.
Marble, imitation, 111.
to clean, 112.
to polish, 111.
to remove stains on, 112.
Mastic, gum, 71.
Metals, polishing, 111.
Mordants for staining wood, 124.
Moths in carpets, to destroy, 118.
Moulding ornaments, etc., 18.
Painting on zinc, 125.
Parchment, tinting on, 119.
to make transparent, 119.
Paste for laying cloth or leather, 102.
Picture frames, 125.
Pictures, to clean, 112.
to smooth damaged, 114.
Polish for turner's work, 38.
French, 36.
improved, 37.
prepared spirits, 37.
revivers, 96.
water-proof, 37.
Putty, 123.
Rasps, 109.
Red stain, 128.
for bedsteads, 128.
Resin, 72.
Rubbing, 30.
Sandarac, gum, 71.
Saws, band, brazing, 106.
circular, to remedy splits in, 106.
sharpening, 106.
Shell-gold, 53.
Silver-size, 54
Solder, soft, preparing, 110.
Stain, black 38.
blue, fine, 42.
brown, 40.
cherry, 41.
crimson, fine, 42.
mahogany, 42.
oak, 40.
purple, 42.
red, 41.
rosewood, 41.
walnut, 40
Stain, yellow, 43.
Staining, 38.
Stains, surface, 42.
to brighten, 43.
to remove from wood, 121.
Steampipes, non-conducting covering for, 108
Steel scrapers, to cut, 105.
Tempera, 67.
Tests for gilding, 122.
Tiles, to remove oil stains from, 120.
Tints, 67.
To imitate Botany Bay wood, 127.
To imitate inlaying of silver strings, 17.
To raise old veneers, 14.
To remove grease from cloth, 122.
To stain beech, 126.
Tones, 67.
Tools, oiling, 107.
to harden, 105.
to mark, 107.
to temper, 105.
varnish for, 108.
Tortoise shell, imitation of, 115.
to polish, 120.
Tracing-paper, 103.
Tracings, to mount, 104.
Turpentine, oil of, 73.
Varnish, amalgam, 109.
amber, pale, 69.
black, 95.
brown hard spirit, 87
cabinet, 81.
carriage, 82.
copal, 80.
crystal, 93.
for cane and basket work, 96.
for iron, 95.
for paper, 93.
for tools, 125.
violin, 126.
for tools, 108.
lacquer, hardwood, 88.
mastic, 71.
sealing-wax, 95.
turpentine, 93.
wainscot, 82.
water, 94.
white spirit, 87.
Varnishes, 69.
application of, 26.
gums and their qualities, 69.
oil, 70
oil, preparation of, 75.
spirit and turpentine, 71.
" " preparation of, 83.
solvents, 72.
alcohol, 74.
linseed-oil, 72.
naphtha, 74.
turpentine, 73.
Varnish pan, 29.
to remove from wood, 121.
Velvet, to clean, 121.
Veneers, to raise old, 101.
Walnut stain, 128.
Waterproof polish, 37.
Wax, black, 120.
finish, 33.
imitation, 33.
green, 120
Wood pulleys, to harden, 109.

Established 1870.

STANDARD BOOKS

PUBLISHED AND FOR SALE BY THE

INDUSTRIAL PUBLICATION CO.

New York.

These books will be sent, postpaid, to any address in any accessible part of the world, on receipt of price.— Full Descriptive Catalogues may be had free.— New Catalogues, with additions of new books, are issued from time to time, and will be sent to any address on request.— Address,

INDUSTRIAL PUBLICATION CO., New York.

THE STEEL SQUARE AND ITS USES.

Being a Description of the Square and Its Uses in Obtaining the Lengths and Bevels of all kinds of Rafters, Hips, Groins, Braces, Brackets, Purlins, Collar-Beams, and Jack-Rafters.— Also, its Application in Obtaining the Bevels and Cuts for Hoppers, Spring Moldings, Octagons, Stairs, Diminished Stiles, &c.— By FRED. T. HODGSON, author of "Practical Carpentry," "The Builders' Guide," &c.— Third Edition, Revised and Greatly Enlarged.— Illustrated by Nearly One Hundred Fine Engravings.— Cloth, gilt. . . $1

This is the only practical work on the steel square and its uses ever published. It is thorough, accurate, clear, and easily understood. Confounding terms and scientific phrases have been religiously avoided where possible; and everything in the book has been made so plain that a boy of twelve years of age, possessing ordinary intelligence, can understand it from end to end.

This new edition, just issued, is illustrated by nearly one hundred handsome engravings, showing how the square may be used for solving nearly every problem in the whole art of carpentry. The carpenter who possesses this book need not waste time and material "cutting and trying." He can lay out his work to a hair's breadth, and "cut to the line." And, in these days, the workman who can not lay out his work accurately at the first attempt stands no show.

The book is absolutely indispensable to every person who may have to use a carpenter's square. Joiners, cabinet-makers, bricklayers, stonecutters, plasterers, lumber-dealers, amateurs, and all who build a fence, tinker a gate, or make a chicken-coop will find something in this little volume that will help and aid them to do their work better and more intelligently than they could without a knowledge of its contents.

Many difficult and troublesome mathematical problems can be solved by the use of this tool, and the methods of solving them are shown in this book. It describes how painting, plastering, and brickwork can be measured, and how many mechanical difficulties can be overcome with great ease. It explains how ellipses, parabolas, octagons, circles, and many other figures, may be described by the steel square.

It is safe to say that this dollar book will easily enable any intelligent mechanic to save ten dollars in time and material during the first three months that he has it in use.

STEEL SQUARES AND THEIR USES.

Being a Description of the Various Steel Squares and Their Uses in Solving a large number of Mechanical Problems in Constructive Carpentry, Joinery, Sheet-metal Work, Cut-stone or Brick-work. Also, showing how many Geometrical and other Problems may be solved by the use of the Steel Square.—By FRED. T. HODGSON, author of "The Steel Square and Its Uses," "The Slide-Rule, and Its Uses," "Practical Carpentry," "The Builders' Guide," &c.—Finely Illustrated.—Cloth. $1

This forms Part II of "*The Steel Square and Its Uses*," and is not in any sense a substitute for the First Part, which still remains what it always has been—a necessity to every intelligent workman. Part II is an extension and enlargement of the First Part, giving new problems, new methods, and new wrinkles for shortening the labor and increasing the accuracy of the workman. It is illustrated in the same handsome manner which characterizes the First Part, to which it forms a companion volume.

With these two volumes in his possession the workman has at command the entire practical mathematics of construction, and is prepared to lay out any piece of work more easily, quickly, and accurately than it can be done by any other method.

PRACTICAL CARPENTRY.

Being a Guide to the Correct Working and Laying-out of all kinds of Carpenters' and Joiners' Work, with the Solutions of the Various Problems in Hip-Roofs, Gothic Work, Centering, Splayed Work, Joints and Jointing, Hingeing, Dovetailing, Mitering, Timber-Splicing, Hopper-work, Skylights, Raking Mouldings, Circular Work, &c.—To which is prefixed a thorough treatise on "Carpenters' Geometry."—By FRED. T. HODGSON, author of "The Steel Square and Its Uses," "The Slide-Rule, and How to Use It," "The Builders' Guide," &c.—Illustrated by over Three Hundred Engravings.—Cloth, gilt. $1

This is the most thorough book of the kind ever published. It is thorough, practical, and reliable; and at the same time is written in a style so plain that any workman or apprentice can easily understand it.

STAIR-BUILDING MADE EASY.

Being a Full and Clear Description of the Art of Building the Bodies, Carriages, and Cases for all kinds of Stairs and Steps.—Together with Illustrations Showing the Manner of Laying Out Stairs, forming Treads and Risers, building Cylinders, preparing Strings; with Instructions for making Carriages for Common, Platform, Dog-legged, and Winding Stairs.—To which is added an Illustrated Glossary of Terms used in Stair-Building, and Designs for Newels, Balusters, Brackets, Stair-Moldings, and Sections of Hand-Rails.—By FRED. T. HODGSON, author of "The Steel Square and Its Uses," &c.—Illustrated by over One Hundred and Twenty Engravings, many of them full-page size.—Cloth, gilt. . . . $1

This work takes hold at the very beginning of the subject, and carries the student along by easy stages until the entire subject of stairbuilding has been unfolded, so far as ordinary practice can ever require. This book, and the following one on *Hand-Railing*, cover nearly the whole subject of *Stair-Building*.

A NEW SYSTEM OF HAND-RAILING.

Or, How to Cut Hand-Railing for Circular and other Stairs, square from the Plank, without the aid of a Falling Mould.—By AN OLD STAIRBUILDER.—Edited and corrected by FRED. T. HODGSON, author of "Stair-building Made Easy," &c.—Cloth, gilt. . . $1

The system is new, novel, economic, and easily learned. Rules, instructions, and working drawings for building rails for seven different kinds of stairs are given.

THE BUILDERS' GUIDE, and Estimators' Price-Book.

Being a Compilation of Current Prices of Lumber, Hardware, Glass, Plumbers' Supplies, Paints, Slates, Stones, Limes, Cements, Bricks, Tin, and other Building Materials. Also, Prices of Labor and Cost of Performing the Several Kinds of Work Required in Building; together with Prices of Doors, Frames, Sashes, Stairs, Moldings, Newels, and other Machine-work.—To which is appended a large number of Building Rules, Data, Tables, and Useful Memoranda, with a Glossary of Architectural and Building Terms.—By FRED. T. HODGSON, author of "The Steel Square and Its Uses," "The Slide-Rule, and How to Use It," "Practical Carpentry," &c.—Cloth. $2

CARPENTERS' and JOINERS' POCKET COMPANION

Containing Rules, Data, and Directions for Laying Out Work, and for Calculating and Estimating.—With Frontispiece showing the parts of an Architectural Column; also containing many other Illustrative Engravings.—Compiled by THOMAS MOLONEY, Carpenter and Joiner.—Cloth. . . . . 50 cents.

This is a compact and handy little volume, containing the most useful rules and memoranda, practically tested by many years' experience in the shop, factory, and building. Also, a treatise on the framing-square. It is by a thoroughly practical man, and contains enough that is not easily found any where else to make it worth more than its price to every intelligent carpenter.

EASY LESSONS IN ARCHITECTURE.

Consisting of a Series of Questions and Answers explaining in Simple Language the Principles and Progress of Architecture from the Earliest Times.—By THOMAS MITCHELL.—Illustrated by nearly One Hundred and Fifty Engravings.—New Edition, with American additions.—Cloth. . . . . 50 cents.

Architecture is not only a profession and an art, but an important branch of every liberal education. No person can be said to be well educated who has not some knowledge of its general principles and of the characteristics of the different styles. The present work is probably the best architectural textbook for beginners ever published. The numerous illustrative engravings make the subject very simple, and prevent all misunderstanding. It tells all about the different styles, their peculiar features, their origin, and the principles that underlie their construction.

HINTS AND AIDS TO BUILDERS.

Gives hints and prices, tells how to measure, explains building terms, and, in short, contains a fund of information for all who are interested in building.—Paper. . . . . 25 cents.

BUCK'S COTTAGE AND OTHER DESIGNS.

Buck's Designs in Architecture, showing a Variety of Designs, together with a large amount of Miscellaneous Matter, making it a very valuable book.—Forty designs for fifty cents.

Just the book you want, if you are going to build a cheap and comfortable home. It shows a great variety of cheap and medium-priced cottages, besides giving a number of useful hints and suggestions on the various questions liable to arise in building, such as selections of site, general arrangement of the plans, sanatary questions, &c. Cottages costing from $500 to $5,000 are shown in considerable variety, and nearly every taste can be satisfied.

The information on site, general arrangement of plan, sanatary matters, &c., is worth a great deal more than the cost of the book.

WATER-CLOSETS.—A Historical, Mechanical, and Sanatary Treatise.—By GLENN BROWN, Architect; Associate American Institute of Architects.—Neatly bound in cloth, gilt title. . $1

This book contains over 250 engravings, drawn expressly for the work by the author. The drawings are so clear that the distinctive features of every device are easily seen at a glance, and the descriptions are particularly full and thorough. Every known water-closet is fully described, and an account given of its qualities, advantages, and defects. The paramount importance of this department of the construction of our houses renders all comment upon the value of such a work unnecessary.

PLASTER: HOW TO MAKE AND HOW TO USE.

Being a Complete Guide for the Plasterer in the Preparation and Application of all kinds of Plaster, Stucco, Portland Cement, Hydraulic Cements, Lime of Tiel, Rosendale and other Cements. With Useful and Practical Information on the Chemistry, Qualities, and Uses of the Various Kinds of Limes and Cements.—Together with Rules for Measuring, Computing, and Valuing Plaster and Stucco Work.—To which is appended an Illustrated Glossary of Terms used in Plastering, &c.—By FRED. T. HODGSON, author of "The Builders' Guide, and Estimators' Price-Book," "Practical Carpentry," &c.—Cloth, gilt. $1

This work is illustrated with numerous engravings in the text, and three plates, giving some forty figures of ceilings, center-pieces, cornices, panels, and soffits. It is an invaluable book for plasterers, bricklayers, masons, builders, architects, and engineers.

HANDSAWS: THEIR USE, CARE, AND ABUSE.

How to Select and How to File Them.—Being a Complete Guide for Selecting, Using, and Filing all kinds of Handsaws, Backsaws, Compass and Keyhole Saws; Web, Hack, and Butchers' Saws; Showing the Shapes, Forms, Angles, Pitches, and Sizes of Saw-teeth suitable for all kinds of Saws, and for all kinds of Wood, Bone, Ivory, and Metal.—Together with Hints and Suggestions on the Choice of Files, Saw-sets, Filing-clamps, and other matters pertaining to the Care and Management of all classes of Hand and other Small Saws.—By FRED. T. HODGSON, author of "The Steel Square and Its Uses," "The Slide-Rule, and How to Use It," "The Builders' Guide," "Practical Carpentry," &c.—Illustrated by over Seventy-five Engravings.—Cloth, gilt. $1

This work is intended more particularly for operative carpenters, joiners, cabinet-makers, carriage-builders, and woodworkers generally, amateurs or professionals.

THE PRACTICAL UPHOLSTERER.

Giving Clear Directions for Skillfully Performing all kinds of Upholsterers' Work in Leather, Silk, Plush, Reps, Cottons, Velvets, and Carpetings.—Also, for Stuffing, Embossing, Welting, and Covering all kinds of Mattresses, &c.—Rules for Measuring Valances, Curtains, Tapestry, Window and Door Drapery, Curtain Rods, Persian Beds, Mantel Drapery, Lambrequins, Cushions, Floor-Cloths, Festoon Blinds and Curtain-Hangings, and all kinds of Upholstery.—Fully Illustrated with Engravings of Tools, Sketches of Furniture, and numerous full-page Illustrations of Original Decorative Designs.—By A PRACTICAL UPHOLSTERER. 12mo, cloth. $1

This work contains a number of original designs in drapery and upholstery, with full explanatory text, and an immense number of working illustrations. It gives a description of tools, appliances, and materials. It tells how to upholster chairs, parlor furniture, bedroom furniture, &c. It contains rules for cutting bed-hangings, window-curtains, door-hangings, blinds, and for measuring and cutting carpets. It gives arithmetical calculations for cutting carpets, curtains, &c., mantle-board drapery, festoons, and, in short, everything pertaining to upholstery.

There is nothing published in this country that is so thorough and complete in the instructions given for upholstering, as this book. It is invaluable alike to the practical workman and the amateur.

CABINET-MAKING, UPHOLSTERING, FURNITURE.

Hints and Practical Information for Cabinet-makers, Upholsterers, and Furniture-men Generally.—Together with a Description of all kinds of Finishing, with Full Directions Therefor; Varnishes, Polishes, Stains for Wood, Dyes for Wood, Gilding and Silvering, Recipes for the Factory, Lacquers, Metals, Marbles, &c.; Pictures, Engravings, &c.—Cloth, gilt. $1

This book contains an immense amount of the most useful information for those who are engaged in the manufacture, superintendence, or construction of furniture or woodwork of any kind. It is one of the cheapest and best books ever published, and contains over one thousand hints, suggestions, and methods; and descriptions of tools, appliances, and materials. All the recipes, rules, and directions have been carefully revised and corrected by practical men of great experience, so that they will be found thoroughly trustworthy. It contains many of the recipes recently sold at from $5 to $500.

THE WORKSHOP COMPANION.—Part I.

A Collection of Useful and Reliable Recipes, Rules, Processes, Methods, Wrinkles, and Practical Hints, for the Household and the Shop. . . . . Paper, 35 cents.—

This is a book of 164 closely printed pages, forming a dictionary of practical information for mechanics, amateurs, housekeepers, farmers,—everybody. It is not a mere collection of newspaper clippings, but a series of original treatises on various subjects, such as alloys, cements, inks, steel, signal-lights, polishing materials, and the art of polishing wood, metals, &c.; varnishing, gilding, silvering, bronzing, lacquering, and the working of brass, ivory, alabaster, iron, steel, glass, &c.

THE WORKSHOP COMPANION.—Part II.

A Collection of Useful and Reliable Recipes, Rules, Processes, Methods, Wrinkles, and Practical Hints, for the Household and the Shop. . . . . Paper, 35 cents.—

This is an extension of the first part, and contains subjects which have not been discussed in the earlier volume. These two volumes contain an immense amount of practical instruction on matters in regard to which information is constantly desired by amateurs and practical men.

THE PRACTICAL ASSISTANT, AND WORKSHOP COMPANION.—

A Treasury of Useful Information relating to the Arts and Sciences of everyday life.—Containing Useful and Reliable Processes, Recipes, Wrinkles, Methods, Rules, Data, Tables; and Hints for the Factory and the Household, the Shop and the Farm.—Edited by JOHN PHIN.—Cloth, ... $1

This is Parts I and II of "The Workshop Companion," described above, handsomely bound together in cloth, with gilt title.

THE AMATEURS' HANDBOOK OF PRACTICAL INFORMATION, for the Workshop and Laboratory.

Second Edition.—Greatly Enlarged.—Neatly bound. . . 15 cents.

This is a handy little book, containing just the information needed by amateurs in the workshop and laboratory. Directions for making alloys, fusible metals, cements, glues, &c.; and for soldering, brazing, lacquering, bronzing, staining and polishing wood, tempering tools, cutting and working glass, varnishing, silvering, gilding, preparing skins, &c. The new edition contains extended directions for preparing polishing powders, freezing mixtures, colored lights for tableaux, solutions for rendering ladies' dresses incombustible, &c. There has also been added a very large number of new and valuable recipes.

The Workshop Companion, Part I, above described, contains *all* the matter that is to be found in "The Amateurs' Handbook."

MECHANICAL DRAUGHTING.

The Student's Illustrated Guide to Practical Draughting.—A series of Practical Instructions for Machinists, Mechanics, Apprentices, and Students at Engineering Establishments and Technical Institutes.—By T. P. PEMBERTON, Draughtsman and Mechanical Engineer.—Illustrated by numerous engravings.—Cloth, gilt. $1

This is a simple but thorough book, by a draughtsman of twenty-five years' experience. It is intended for beginners and self taught students, as well as for those who pursue the study under the direction of a teacher.

DRAWING INSTRUMENTS.

Being a Treatise on Draughting Instruments, with Rules for their Use and Care; Explanations of Scales, Sectors, and Protractors. Together with Memoranda for Draughtsmen; Hints on Purchasing Instruments, Paper, Ink, Pencils, &c. Also, a Price-list of all Materials required by Draughtsmen.—Illustrated with twenty-four Explanatory Illustrations.—By FRED. T. HODGSON.—Paper. . . . 25 cents.

THE SLIDE-RULE, AND HOW TO USE IT.

Being a Compilation of Explanations, Rules, and Instructions, suitable for Mechanics and others interested in the Industrial Arts.—Compiled and arranged by FRED. T. HODGSON.—25 cents.

Rules are given for the measurement of all kinds of boards and planks, timber in the round or square, glaziers' work and painting, brickwork, paviors' work, tiling and slating, the measurement of vessels of various shapes, the wedge, inclined planes, wheels and axles, levers, the weighing and measurement of metals and all solid bodies, cylinders, cones, globes, octagon rules and formulæ, the measurement of circles, and a comparison of French and English measures, with much other information useful to builders, carpenters, bricklayers, glaziers, paviors, slaters, machinists, and other mechanics.

Possessed of this little book and a good slide-rule, mechanics might carry in their pockets some hundreds of times the power of calculation that they now have in their heads, and the use of the instrument is very easily acquired.

THE ENGINEER'S SLIDE-RULE, and Its Applications.

A Complete Investigation of the Principles upon which the Slide-Rule is constructed; together with the Method of its Application to all the Purposes of the Practical Mechanic.—By WILLIAM TONKES.—Paper. . . . . 25 cents.

THE LIGHTNING CALCULATOR.

Practical Hints on Lightning Calculating.—To which are added Rules, Tables, Data, Formulæ, and Memoranda, for making rapidly those everyday calculations that are required in business, mechanics, and agriculture.—Paper. . . . . 20 cents.

A CENTURY OF INVENTIONS.

An exact reprint of the famous "Century of Inventions" of the Marquis of Worcester (first published in 1663).—With an Introduction, Notes, and a Life of the Author.—With Portrait after a Painting by Van Dyke.—Edited by JOHN PHIN.—Cloth. . . . $1

This is one of the most extraordinary books ever published. The famous "Century of Inventions" is of more than mere historical interest. It contains numerous hints and suggestions of what might be accomplished, and will be found of great interest and value to every one interested in mechanics. Many persons claim that the Marquis of Worcester anticipated many of our most important modern inventions and discoveries. Great care has been taken to reproduce exactly (so far as modern type, &c., could do it) the edition published by the Marquis himself. It has been entirely out of print for many years.

THE ELECTRICIAN'S POCKET COMPANION.

Electrical Rules, Tables, Tests, and Formulæ.—By ANDREW JAMIESON, C.E., F.R.S.E.—Fully illustrated.—Cloth. . . . 75 cents.

This is the most compact and thorough work in the market for the practical electrician. It contains minute directions for all calculations, tests, &c., with clear engravings of the apparatus employed. The following list of contents will give an idea of its scope:—

Formulæ of the Absolute Units,—Practical, Electrical, and Mechanical.
Heat and Light Units.
Electro-chemical Equivalents, Electrolysis, Heat and Energy of Combustion.
Practical Methods of Electrical Measurements.
Electric Conductors: Copper, &c.—Insulators: Guttapercha, &c.
Submarine Cables.—Aerial Land-lines.
Electric Lighting, and Transmission of Power.

LECTURES IN A WORKSHOP.—By T. P. PEMBERTON,

formerly Associate Editor of *The Technologist;* author of "The Student's Illustrated Guide to Practical Draughting."—With an Appendix containing the famous papers by Whitworth "On Plane Metallic Surfaces of True Planes"; "On the Uniform System of Screw-Threads"; "Address to the Institution of Mechanical Engineers, Glasgow"; "On Standard Decimal Measures of Length." Cloth, gilt.. . . . . $1

We have here a sprightly, fascinating book, full of valuable hints, interesting anecdotes, and sharp sayings. It is not a compilation of dull sermons or dry mathematics, but a live, readable book. The papers by Whitworth, now first made readily accessible to the American reader, form the basis of our modern systems of accurate work.

THE NEW POCKET CYCLOPEDIA.

A Compendium of General Knowledge, Useful and Interesting Facts, Valuable Statistics, and Practical Information.—16mo., cloth. . . . . 50 cents.

This is a handy volume of 164 pages, printed in small but clear type on very fine thin paper, so that the book may be readily carried in the pocket or trunk. It contains all those facts and figures which are most commonly referred to in everyday life, great care being taken to secure accuracy and clearness. It is not a collection of "curious information" made up from newspaper clippings, but a thoroughly arranged manual of the most useful general knowledge.

HOW TO BECOME A GOOD MECHANIC.

Intended as a Practical Guide to Self-taught Men: Telling What to Study; What Books to Use; How to Begin; What Difficulties will be met; How to Overcome Them. In a word, how to carry on such a course of self-instruction as will enable the young mechanic to rise from the bench to something higher.—Paper, 15c.

This is not a book of "goody-goody" advice, neither is it an advertisement of any special system, nor does it advocate any hobby. It gives plain practical advice in regard to acquiring that knowledge which alone can enable a young man engaged in any profession or occupation connected with the industrial arts to attain a position higher than that of a mere workman.

CEMENTS, GLUE, AND PASTE.

A Practical Treatise on the Preparation and Use of all kinds of Cements, Glue, and Paste.—By JOHN PHIN, author of "How to Use the Microscope."—Paper. . . . . 25 cents.

Every mechanic and householder will find this volume of almost every-day use. It contains nearly two hundred recipes for the preparation of cements for almost every conceivable purpose.

HINTS FOR PAINTERS, DECORATORS, AND PAPER-HANGERS.

Being a Selection of Useful Rules, Data, Memoranda, Methods, and Suggestions for House, Ship, and Furniture Painting; Paper-Hanging, Gilding, Color-Mixing, and other matters useful and instructive to painters and decorators.—Prepared with special reference to the wants of amateurs.—By AN OLD HAND.—Paper. . . . . 25 cents.

THE HARDWOOD FINISHER:

With Rules and Directions for finishing in Natural Colors, and in Antique, Mahogany, Cherry, Birch, Walnut, Oak, Ash, Redwood, Sycamore, Pine, and all other Domestic Woods. Finishing, Filling, Staining, Varnishing, and Polishing. Also, Miscellaneous Rules for Dyeing, Gilding, and Bronzing.—Compiled and Edited by FRED. T. HODGSON, late Editor of *The Builder and Woodworker*, and of *The Cabinetmaker and Upholsterer*.—12mo, cloth. . . $1

In this country the art of using wood for almost every purpose has gone far beyond anything that has ever been attempted by any other people. The modern houses of the Americans are finished with a richness and beauty in the woodwork of which our fathers, not to speak of our grandfathers, had little idea. The carpenter, builder, or painter who does not fully understand the best methods of finishing the hard woods so as to preserve and increase their beauty is behind the times. The object of this book is to aid him in acquiring the knowledge necessary to this end; and the author has certainly succeeded in producing an exhaustive treatise on the subject.

THE ENGINEER'S HANDY-BOOK:

Containing a series of Useful Calculations for Engineers, Toolmakers, Millwrights, Draughtsmen, Foremen in Engineering Establishments, and for the better class of Mechanics and Artizans generally. Also, Rules to determine the Proportion of Wheels for Screw-cutting by a Lathe, &c.—From the fifth London edition, with American additions.—32mo, cloth. . . . . 50 cents.

PLAIN DIRECTIONS FOR THE

CONSTRUCTION AND ERECTION of LIGHTNING-RODS.

—By JOHN PHIN, C.E., author of "Chemical History of the Six Days of Creation," "How to Use the Microscope," &c. Enlarged and fully illustrated.—Third edition.—12mo, cloth, gilt title. . . . . 75 cents.

This is a well-known and standard work. It is simple and practical, intended to convey just such information as will enable every property-owner to decide whether or not his buildings are thoroughly protected. It is the only book on this subject published in this country that has not been written in the interest of some patent or some manufacturing concern. By following its directions any ordinarily skillful mechanic can put up a rod that will afford perfect protection, and that will not infringe on any patent. Every owner of a house or barn ought to procure a copy.

TRADE "SECRETS" AND PRIVATE RECIPES.

A Collection of Recipes, Processes, and Formulas that have been offered for sale at prices varying from 25 cents to $500. With Notes, Corrections, Additions, and Special Hints for Improvements.—Edited by JOHN PHIN, assisted by an experienced and skillful pharmacist.—Cloth, gilt title. . . . . 60 cents.

This work was prepared by the author for the purpose of collecting and presenting in a compact form all those recipes and so-called "trade secrets" which have been so extensively advertised and offered for sale. It is by no means a claptrap book, though it exposes many claptraps. It contains a large amount of valuable information that can not be readily found elsewhere; and it gives not only the formulæ, &c., for manufacturing an immense variety of articles, but important and trustworthy hints as to the best way of making money out of them. Even as a book of recipes it is worth more than its price to any one who is interested in the subject on which it treats.

A PRACTICAL GUIDE TO

SUCCESS IN THE USE OF RECIPES,

Formulæ, &c., with Hints on Chemical and Mechanical Manipulation.—Intended as a supplement to all books of recipes.—By JOHN PHIN.—12mo, paper. . . . . 25 cents.

While it is an undoubted fact that many of the recipes published in the ordinary collections are erroneous, either from original blunders on the part of the authors or from mistakes in copying, failure in the use of others frequently arises from defective information and vicious methods on the part of those who attempt to put them in practice. The object of the present book is to give such hints and cautions as will enable the worker to secure success where success is possible; and where the products are intended for sale it gives special and valuable advice as to the best methods of putting them on the market.

A MANUAL OF INSTRUCTION IN

THE ART OF WOOD ENGRAVING.

With a Description of the necessary Tools and Apparatus, and Concise Directions for their Use; Explanations of the Terms used and the Methods employed for producing the various classes of Wood Engravings.—By S. E. FULLER.—Fully illustrated with engravings by the author, separate sheets of engravings for transfer and practice being added.—New edition, neatly bound. 50 cts.

A really thorough and practical work, written for those who want to learn the art without the aid of a teacher.

A GUIDE TO COLLODIO ETCHING.—By

Rev. BENJAMIN HARTLEY.—Illustrated by the author.—12mo, cloth. $1.00

This volume gives complete and minute instructions for one of the most delightful of amateur arts. It is fully illustrated by woodcuts of all the apparatus used (which is very simple and easily made), and also by actual photo-prints of the etchings themselves.

THE PRACTICAL POCKET COMPANION.

A Cyclopedia of the most useful Facts, Figures, and General Information required by everybody in everyday life.—Edited by JOHN PHIN, author of "How to Use the Microscope," "The Workshop Companion," "Chemical History of the Six Days of Creation," &c.—Numerous illustrations. . . . . 10 cents.

CONTENTS.—Abbreviations in Common Use—Business Laws and Commercial Rules—Acceptances—Agencies—Bills of Exchange—Cheques—Common Carriers—Corporations—Law of Finding—Indorsements—Innkeepers—Negotiable Instruments—Partnerships—Promissory Notes—Protests—Receipts—Concrete Walls for Houses—Copyrights—Rules for Correspondence—How to treat Accidents to the Eye—Factors of Safety—Best Methods of Extinguishing Fires—Language of Flowers—Significance of Gems and Precious Stones—Periods of Gestation and Incubation—Legal Holidays—Homestead Law—Distinguishing Characteristics and Anxious Periods of Infectious Diseases—Prevention of Attacks of Insects—Knots, and How to Tie Them, with full page of illustrations—General Rules—Single Draw-knot—Galley-knot—Square-knot, or Reefing-knot—Weaver's-knot, or Sheet-bend-knot—Half-hitch—Two Half-hitches—Clove-hitch—Timber-hitch—Bowline-knot—Fisherman's-knot—Whipping or Binding—Tying Parcels—Care of Leather—Lightning-rods, general rules for—Best Materials—Proper Size and Best Shapes of Rod—Painting—Points, or Air-Terminals—Ground Connections—Arrangement and Mode of Attaching the Rod to the House—Value of Moneys of Foreign Nations—Passports—Patents—Antidotes for Poisons—Postal Rules and Rates—Railroad and Steamboat Signals—Rules for Spelling and the Use of Capitals—Trade-marks—Weather Indications, &c.

WHAT TO DO AND HOW TO DO IT IN CASE OF ACCIDENT.—A book for everybody.—Cloth, gilt. 50 cts.

This is one of the most useful books ever published. It tells exactly what to do in case of accidents, such as severe cuts, sprains, dislocations, broken bones, burns with fire, scalds, burns with corrosive chemicals, sunstroke, suffocation by foul air, hanging, drowning, frost-bite, fainting, stings, starvation, lightning, poisons, accidents from machinery and from the falling of scaffolding, gunshot wounds, &c. It ought to be in every house, for young and old are liable to accident, and the directions given in this book might be the means of saving many a valuable life.

COMMON SENSE IN THE POULTRY-YARD.

A Story of Failures and Successes, including a full account of 1,000 hens and what they did. With a complete description of the houses, coops, fences, runs, methods of feeding, breeding, marketing, &c., and many new wrinkles and economical dodges.—By J. P. HAIG.—With numerous illustrations.—Cloth, gilt title. $1

This is a lively and entertaining work, which embodies the actual experience of many years in the keeping of poultry in large and small numbers. It is the most thoroughly practical work on poultry in the market, and contains an amount of solid information which, to even the keeper of a dozen fowls, will make it worth many times its cost.

A DICTIONARY OF PRACTICAL BEE-KEEPING.

With Notes and Practical Hints.—By JOHN PHIN, author of "How to Use the Microscope," &c.—Numerous illustrations.—Cloth, gilt. . . . . 50 cents.

This work discusses thoroughly nearly five hundred subjects. Gives in condensed form an immense amount of valuable information under the different headings. Under the heads *Bee, Comb, Glucose, Honey, Race, Species, Sugar, Wax*, and others, it brings together a large number of important facts and figures now scattered through our bee literature and costly scientific works, and are not easily found when wanted. Here they can be referred to at once under the proper head.

PLAIN DIRECTIONS FOR ACQUIRING

THE ART OF SHOOTING ON THE WING.

With Useful Hints concerning all that relates to Guns and Shooting, particularly in regard to the art of loading so as to kill. To which has been added several valuable and hitherto secret recipes, of great practical importance to the sportsman.—By AN OLD GAME-KEEPER.—12mo, cloth. . . . . 75 cents.

This book contains a novel and most valuable feature found in no other work on this subject. This is a series of graduated lessons by which the self-taught young sportsman is enabled to advance step by step from such easy marks as a sheet of paper nailed on a fence to the most difficult trap-shooting and the sharpest snap-shots.

THE PISTOL AS A WEAPON OF DEFENCE,

In the House and on the Road.—12mo, cloth. . . . 50 cents.

This work aims to instruct peaceable and law-abiding citizens in the best means of protecting themselves from the attacks of the brutal and the lawless, and it is the only practical book published on this subject. Its contents are as follows:—

The Pistol as a Weapon of Defence—The Carrying of Firearms—Different kinds of Pistols in Market—How to Choose a Pistol—Ammunition, different kinds: powder, caps, bullets, copper cartridges, &c.—Best form of Bullet—How to Load—Best Charge for Pistols—How to Regulate the Charge—Care of the Pistol: how to clean it—How to Handle and Carry the Pistol—How to Learn to Shoot—Practical Use of the Pistol—How to Protect Yourself and Disable your Antagonist.

CHEMICAL HISTORY of the SIX DAYS of CREATION

By JOHN PHIN, author of "How to Use the Microscope," &c. 12mo, cloth. . . . . 75 cents.

In this volume an attempt is made to trace the evolution of our globe from the primeval state of nebulous mist, "without form and void," and existing in "darkness," or with an entire absence of the manifestation of the physical forces, to the condition in which it was fitted to become the habitation of man. While the statements and conclusions are rigidly scientific, it gives some exceedingly novel views of a rather hackneyed subject.

THE SUN: A Familiar Description of his Phenomena.

By Rev. THOMAS WILLIAM WEBB, M.A., F.R.A.S., author of "Celestial Objects for Common Telescopes."—With numerous illustrations.—12mo, cloth. . . . . 40 cents.

This work gives, in a delightfully popular style, an account of the most recent discoveries in regard to the sun. It is freely illustrated.

HOW TO USE THE MICROSCOPE.

A Book of Practical Hints on the Selection and Use of the Microscope. Intended for beginners.—By JOHN PHIN, editor of *The American Journal of Microscopy*.—Sixth edition. Greatly enlarged, with over eighty engravings in the text, and eight full-page engravings, printed on heavy tint paper.—12mo, cloth. $1.25

This work has been received with such general favor that it has passed through five large editions in a few years. It gives a full account of the different kinds of microscopes; of the various accessories, and of the best methods of using them; of the best methods of collecting, preparing, and preserving objects, and preparing slides and cabinets. Many of the illustrations, devices, and methods used, are original with the author, although they have been freely copied and appropriated without credit by several other writers.

A BOOK FOR BEGINNERS WITH THE MICROSCOPE.

Being an abridgement of "How to Use the Microscope."—By JOHN PHIN.—Fully illustrated, and neatly and strongly bound in cloth . . . . . 50 cents.

This book was prepared for the use of those who, having no knowledge of the use of the microscope,—or, indeed, of any scientific apparatus,—desire simple and practical instruction in the best methods of managing the instrument and preparing objects.

THE MICROSCOPE.—By ANDREW ROSS.—Fully illustrated.

12mo, cloth, gilt title. . . . . 75 cents.

This is the celebrated article contributed by Andrew Ross to "The Penny Cyclopedia," and quoted so frequently by writers on the microscope. Carpenter and Hogg, in the latest editions of their works on the microscope, and Brooke, in his treatise on Natural Philosophy, all refer to this article as the best source for full and clear information in regard to the principles upon which the modern achromatic microscope is constructed. It should be in the library of every person to whom the microscope is more than a toy. It is written in simple language, free from abstruse technicalities.

A Novelty In Journalism.

INDUSTRIAL RECEIPTS.

A MONTHLY JOURNAL OF

Technical Information for Workers.

In Every Department of the Industrial Arts.

Every mechanic, farmer, housekeeper, student of practical science and amateur has occasion at one time or another to hunt up a **RECEIPT** for making some preparation or performing some operation which is necessary in the ordinary course of work. Hence a book of receipts is almost a necessity in every WORKSHOP, LABORATORY AND HOUSEHOLD.

The object of INDUSTRIAL RECEIPTS is not only to furnish a Complete Collection of Tried Formulæ, Rules and Directions, but to give such current notes, hints and information as will enable the reader to take advantage of the latest improvements and discoveries in this direction. To accomplish this we propose to adopt the following original and, as we think, very feasible plan:

1—We will give, in consecutive numbers, and in alphabetical order, a complete body of Receipts and Technical Information. This will be so paged that when complete it may be bound into a convenient volume for reference, thus forming a complete "Cyclopædia of Practical Receipts."

2—Notes upon new materials and formulæ, with special discussions of processes, methods of working, etc.

3—Special information for subscribers given under the head of answers to correspondents. In this department we have secured the assistance of several able and thoroughly practical scientists.

4—Notices of Current Events, New Books and other matters relating to our specialty, with Abstracts of Important Papers.

—o—

The price of the Journal will be $1.00 per year. Single numbers, 10 cents. Specimen numbers will be sent on receipt of 5 cents (postage stamps will do).

CLUB RATES—As it is our object to attain a large circulation we offer special inducements to those who wish to aid us in this direction. To those who send us *three* subscribers at $1.00 each we will send a fourth copy *free*. An hour's work will therefore enable almost any one to obtain a copy of this exceedingly valuable work.

Address all communications to

The Industrial Publication Company,

10 Thomas Street, = = = NEW YORK, N. Y.

IMPORTANT ANNOUNCEMENT

TO ARCHITECTS, CONTRACTORS AND BUILDERS.

For many years past there has been a want by the building fraternity of a good and reliable book on ESTIMATING, one that will give prices of materials and labor for every department of building, so far as this is possible. Such a book, the publishers believe, has at last been produced, and is now offered to those interested.

THE BUILDER'S GUIDE,

AND ESTIMATOR'S PRICE BOOK.

By FRED. T. HODGSON.

HANDSOMELY BOUND IN CLOTH, GILT TITLE. PRICE, - $2.00.

Current Prices of Lumber, Hardware, Glass, Plumbers' Supplies, Paints, Slates, Stones, Limes, Cements, Bricks, Tin and other Building Materials; also, Prices of Labor, and Cost of Performing the Several Kinds of Work Required in Building. Together with Prices of Doors, Frames, Sashes, Stairs, Mouldings, Newels, and other Machine Work. To which is appended a large number of Building Rules, Data, Tables and Useful Memoranda, with a Glossary of Architectural and Building Terms.

This is an entirely new work, and gives Prices of Labor and Materials down to a recent date, and is, therefore, the most reliable book in the market on the subject of prices of labor and materials required for building. The work contains, besides Prices, Data, Rules, and Several Hundred Tables and Hints on Building, a blank column where the prices of Labor or Material may be written in pencil, where such prices differ from those given in the book. There is also a very complete Glossary of Building and Architectural Terms appended to the work, which is a useful and valuable addition for practical builders.

The work is really a Cyclopædia of Prices and Builder's Tables, Data and Memoranda, and is necessarily a large work, having over 330 pages, each page being 7¼ x 4¾, and covered with closely printed matter.

In order to give an idea of what the work contains, we give the following brief

SYNOPSIS OF CONTENTS:

PART I.—Contains Hints and Rules for Correct Estimating.—Forms for Taking Estimates, Quantities, Prices, and Manner of Computation.—General Memoranda of Items for Estimates.—Excavations.—Foundations.—Drains.—Iron Work.—Baths and Water Closets.—Brick Walls. Carpenter's Work.—Joiner's Work.—Mantels, Grates, Stove Fittings, etc.—Pantry, Closets, Kitchens and Appurtenances.—Bell Hanging, Gas Fixing and Fixtures.—Stairs and Staircases.—Roofs, Gutters and Conductors.—Porches, Verandas and Fences.—Framing; Cost of same.—Cost of Painting, Plastering, Shingling, Slating, Tinning, Finishing, Glazing, Building Chimneys, and other Brick Work.—Rules for Measuring all kinds of Hip and other Roofs, with Cost of same.—Rough Boarding, Shingling, Siding, Laying Floors, and other Work.—Cost of Material and Labor for Stairs, Newels, Balusters, Rails, Doors, Mouldings, Sliding and Folding Doors, Windows of all kinds, Blinds, Wainscoting, Baseboards, Finials, Cresting, Plumbing, Flooring, and everything else used about a Building.

PART II.—Contains an Extensive Schedule of Builder's Prices, for Digging, Shovelling, Ramming in Loose Earth, Clay and Gravel.—Cost of Masonry, Rubble, Hammer-Dressed Work, Rough Rock Work, Reveals, Ashler Work, Re-

pairs, Arches, Plain Work, Rubbed Work, Beaded Work, Fluting, Reeding, Throating, Grooving, Rebating, Leading in Work, Sunken Work, Morti-sing, etc.—Prices of all kinds of Native Stones per Cubic Foot. Prices of Cements: Portland, Rosendale, Keene's, Lime of Teil, Lime, Lath, Slate, etc. Bricklaying; Price per 1,000, Laborer's Wages, Prices of Bricks of Different Grades, Circular and Elliptical Work, Brick Paving of all kinds, Laid Dry or in Mortar. Drain Pipes, Cost and Quality; Terra-Cotta Chimney Tops, Cresting, Tiles and Mouldings, etc.—Colored Bricks, Tuck Pointing, Setting in Sash and Door Frames, Taking Down Old Work, Rebuilding with Old Bricks, Firebricks, Tile Work, Quality and Prices of Bricks from Various Localities, Prices of Peerless Brick Company's Colored Bricks, Colored Mortars and Cements, Odd-Shaped Bricks.—Plasterer's Work, Scaffolding, Lathing, Mortars for all kinds of Work, Cements for Walls and Ceilings, Cornices and Stucco Work, Plaster-of-Paris Flower and Ornamental Work, Kalsomining and Washes of all Kinds. Carpenter's and Joiner's Work; Wages, Prices of Lumber, Prices of Made-up Stuff of all Kinds.—Hard-wood Work, Nails, Screws, Locks, Butts and other Hardware.—Stairs of all Kinds, Table for Finding the Run and Rise of Treads and Risers, Turned Work for Stairs and other Work.—Painting, Colors, Prices for Different Kinds of Work, Ladders, Scaffolding, Tools, Graining, Painting Iron Work, Staining, Repairing Old Work, Numerical Work, Varnishing, Lettering, Oiling, Sash and Door Painting, Mixing Colors, Prices of Colors, Miscellaneous Remarks.—Roofing Materials of all Kinds, with Prices and Cost of Laying; Bell-Hanging Materials, Skylights, Tubs, Sinks, Sheet Iron, Pumps, Tanks, Registers, Ventilators, Wire Ropes, and other matters required in Building.

PART III.—Contains Rules for Builder's Bookkeeping, Form of Balance Sheet, Rules for Measuring Artificer's Work, including Excavation, Drains, Shoring, Concreting, and Labor in General: also Methods of Measuring all Kinds of Materials for Brick, Stone, or Wood Work.—Elements of the Mechanics of Architecture, Strength of Materials, Rules for Obtaining Same; Iron, Wood, Stone and Brick, Crushing Loads for Various Building Materials, Columns, Iron, Wood, Stone.—Tables for Computing the Strength of Materials, Factors of Safety, Rolled-Iron Beams and Girders.—Bricks and Brick Piers, Terra-Cotta, Strength and Qualities of Cements and Mortars, Fire-Brick, Colored Mortars, Granite and other Stone.

PART IV.—Miscellaneous Tables.—Weight of Iron, Lead, Brass, Copper and Cast Iron, per Foot Superficial or in Bars; Strength of Round Ropes, Weight of Boiler Iron, Wrought-Iron Pipes, Flat and Round Wire Ropes for Elevators, Iron Roofing, Lead Pipes, Nails, Foreign Weights and Measures, Force of Wind, Square Measure, Long Measure, Equivalents, Arithmetical and other Signs, Expansion by Heat, Force of Explosives, Number of Shingles, Slates, Tiles and other Covering Required for 100 feet of Roofing, Number of Bricks Required for Given Wall, Strength of Woods, Loads for Bridges, Strains on Bridges and Trusses, Specific Gravities.

PART V.—Mensuration of Superfices, Areas of Squares, Cubes, Triangles, Multi-sided Figures, etc.; Measurements of Solids, Cubes, Cones, Cylinders, Spheres, etc.; Squares and Cubes of Numbers, Table of Spherical Contents, Diameters, Circumferences and Areas of Circles, Board and Plank Measure, Scantling Measure, Wages Table, Sizes and Capacities of Cribs, Boxes and Tanks.

PART VI.—Mechanics' Lien Laws of Alabama, Arkansas, Connecticut, California, Colorado, District of Columbia, Delaware, Florida, Georgia, Indiana, Iowa, Illinois, Kansas, Kentucky, Maine, Louisiana, Massachusetts, Maryland, Mississippi, Michigan, Missouri, New Jersey, Nevada, Nebraska, New Hampshire, North Carolina, New York, Oregon, Ohio, Pennsylvania, Rhode Island, South Carolina, Texas, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, Ontario.

PART VII.—Schedule of Architect's Charges, Drawings, Superintendence, Percentage on Public Buildings.—Architect's Rules and Methods of Charging for Services Rendered.—Leading Architectural and Building Journals.—Glossary of Architectural and Building Terms. (This "Glossary" covers some fifty-seven pages, and deals with over One Thousand Terms used in Architecture and Building).

Just Published.

THE UNIVERSAL

CARPENTER AND JOINER.

By FRED T. HODGSON,

Author of "The Steel Square and Its Uses," "Practical Carpentry," "Stairbuilding Made Easy," "The Builder's Guide and Estimator's Price-Book," etc., etc.

PART I.

This part is devoted to Carpenter's Geometry, which is presented in simple form, giving easily understood methods of Describing Mouldings, Gothic Arches, Turned Works, Ornaments; Drawing Instruments; Care of Instruments; Scales, How to Use Them; Various Methods of Copying Drawings—the Blue Process, the Black Process; Waxing; Use of the Pantagraph, etc., etc. It gives not only the rules and theory, but examples of their practical applications in Carpentry and Joinery, showing how to get and work difficult "cuts" and pitches.

Over 250 Illustrations. Royal 8vo, bound in stiff paper cover, $1.00

The aim of the Author is to make the above work the most complete treatise on Carpentry and Joinery published to date, and the publishers have no hesitation in saying that the success which Mr. Hodgson has achieved during the past twenty years in furnishing the mechanics of this country with thoroughly reliable and easily understood text-books, is a sure guarantee of the excellence of his present effort.

It will be issued in Five Parts, each Part consisting of over 100 large royal octavo pages, printed on fine paper, and strongly bound in stiff paper covers; and as it is the intention of the publishers to place this important work within the reach of every industrious mechanic and apprentice in the land, they have placed the price at $1.00 per Part. Many works in the market, containing no more matter than a single Part, and not so well illustrated, are now selling for from $5.00 to $10.00 each.

EACH PART WILL BE COMPLETE IN ITSELF.

When complete, the Five Parts will form a handsome volume, the price of which, bound in extra cloth, in the very best style of the art, will be $5.00.

Part II, which is the most handsomely illustrated volume on Carpentry now before the public, is nearly ready

Industrial Publication Company,

16 Thomas Street, - - - NEW YORK N. Y.

GETTY CENTER LIBRARY
3 3125 00141 3026